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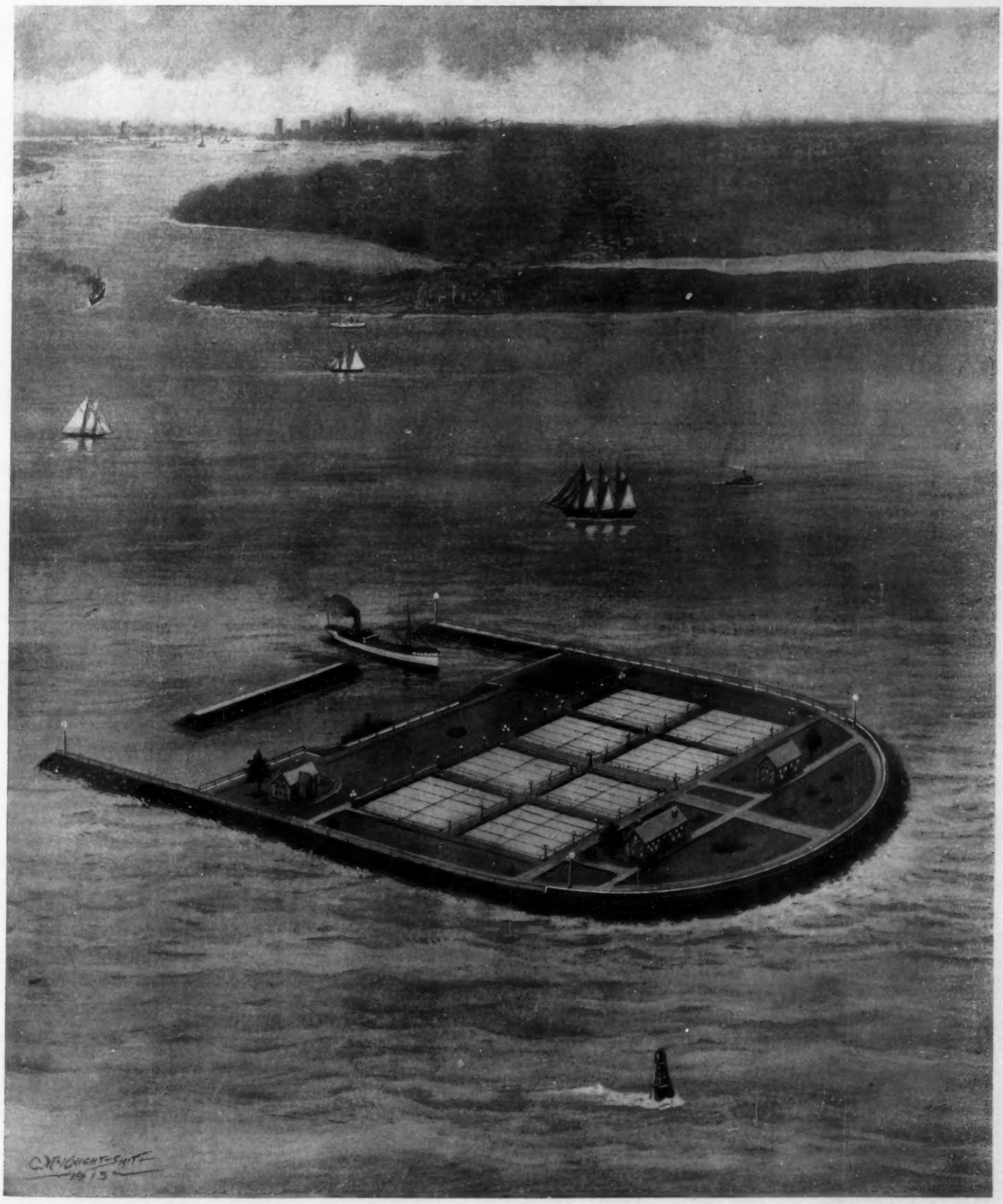

It is proposed to carry a large part of the sewage by a tunnel 10 feet in diameter under the lower bay to an artificial island three miles offshore, where the solids will be removed and taken out to sea in tank steamers and the liquids will be rendered harmless before being discharged.

PLAN FOR THE DISPOSAL OF NEW YORK'S SEWAGE.—[See page 490.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Science and the Cost of Living

WE are well accustomed to the truism that all science ultimately finds practical application. But we do not always equally realize that all practice has a scientific basis. Approach the average business man on the subject of the theory of wealth, and he will probably wave you aside with the statement that he is too busy with the practice of producing values to pay much attention to theories, however "pretty."

This may be all very well for many purposes: empirical methods and rule of thumb often answer well enough. But in a problem of national and international importance we can not afford to proceed by cut and try methods, when science clearly points the way to him who will listen.

Everyone is keenly interested in the phenomenal rise in the cost of living which has taken place within the last sixteen years—a rise of no less than 59 per cent! And so everyone deems himself qualified to account for the phenomenon. Each naturally sees the cause of the condition in some circumstance that happens to be his pet grievance—the tariff, the trusts, trades unions, the introduction of machinery, or whatever it may be.

The futility of some of these attempts at explaining the situation is perfectly obvious to one who has made an unbiased study of the facts. Our tariff can evidently not be the cause of a condition which has been observed equally in England, France, Germany and elsewhere, as well as in our own country, as is clearly shown by Prof. J. P. Norton in an article, "The Changing Cost of Living," in this week's issue of our SUPPLEMENT.

As a matter of fact, the theory of currency furnishes an explanation which is as simple as it is convincing. Yet few people had, until recently, taken note of this simple truth. It was first pointed out by Samuel Newcomb that the purchasing power of an ounce of gold (supposing for the sake of simplicity that all purchases are made in gold) depends on two factors: first, the total amount of gold in circulation, and secondly, the rapidity of circulation. To quote A. Del Mar ("The Science of Money"): "Suppose that 150,000 million dollars worth of exchanges are to be transacted in a year, and suppose the only kind of money to be used consists of gold dollars. If these dollars could be used but once during the year, it follows that it would take 150,000 millions of them to effect the exchanges. If they could be used and re-used fifty times a year, 3,000 millions of them would suffice to effect the exchanges;" that is to say, the purchasing power of the ounce of gold would be fifty times greater than in the preceding case.

If, then, the purchasing power of gold thus depends on these two factors, the total amount of gold in circulation, and the rapidity of circulation, we must expect that any marked change in either of these factors will be accompanied by a corresponding change in the price of commodities. The rapidity of circulation is subject to seasonable fluctuations, owing to the effects of the seasons upon trade and agriculture, and the "price of money" fluctuates accordingly. Again, the total amount of gold in circulation has been increasing steadily for many years, as the output of the world's gold mines is many times greater than the loss of gold incidental to commerce and industry. This must necessarily bring in its train a fall in the purchasing power of gold, or, what amounts to the same thing, a rise in the cost of living, all the world over. No local legislation of any kind can possibly stem the tide, any more than we can hope by man-made laws to overcome the action of gravitation.

The fact that this simple fundamental law of the theory of currency was discovered by an astronomer and mathematician, and remained unnoticed by the bulk of "economists" for some twenty years, until unearthed and brought into the light by Profs. Kemmerer and Irving Fisher, carries a moral of its own. The non-mathematical is often inclined to speak somewhat flippantly of the "formulæ" of the mathematician. No sneer was ever more utterly misplaced than this. No problem can be said to be completely solved until it has been cast into mathematical form. And many a "scientific" controversy rages for years, simply because the contestants have not sufficient mathematical judgment and training to count the number of variables involved in a problem, and the number of independent equations connecting such variables. So long as the former number exceeds the latter, the problem is necessarily indeterminate, and there are a number of possible solutions. A number of persons who, unaware of this, each insists on a solution of his own selecting, may evidently go on arguing forever without coming to an agreement. This is what is apt to occur in a branch of science where the mathematical method of treatment is neglected or even despised.

Cold Light

THE invention of Prof. C. F. Dussaud, described and illustrated on another page in this issue, once more attracts attention to our present methods of illumination. Between the glow worm and the incandescent lamp there yawns a gap which will some day be bridged by the combined aid of the physicist, chemist, engineer, and metallurgist. The luminous creatures of nature, considered as lighting machines, operate at an efficiency of about ninety-five per cent. The best incandescent lamp of the day has an efficiency of about two per cent. Clearly, we have still much to learn from the firefly.

It is only within the last ten years that this problem has been systematically attacked. At least a score of highly trained scientists on this side of the ocean alone have applied themselves to the task of improving our methods of illumination. The new profession of "illuminating engineering" has been created—a calling which is followed by men who have studied the art of distributing light most effectively. Psychologists, even, have been recruited in the effort to provide us with cheap and satisfactory artificial light; for it is now recognized that much of the world's work is done at midnight and that the human eye, the most delicate and responsive organ of the entire body, cannot be recklessly overtaxed.

In this systematic study of illumination much has been discovered which has encouraged the laboratory workers. A spectroscopic study of the firefly's light by Drs. Ives and Coblentz, along the lines long ago laid down by Langley, has shown that the intermittent flashes of the insect are spectroscopically akin to the radiation of the mercury vapor arc. Both lights are greenish yellow, or yellowish green. Of all the radiations in the spectrum, the yellowish green portion is luminously most efficient. Hence, the mercury arc in a sense, is a continuously glowing artificial firefly of glass and mercury vapor, and hence man has been unwittingly following in nature's footsteps.

Encouraging as this is, it is doubtful if a light as cold as a luminous insect's will ever be really attained. Indeed, it may be doubted if we want the artificial equivalent of a firefly. Because the mercury arc radiation is decidedly unpleasant a gigantic firefly's luminosity would be no more agreeable. It is absolutely certain that light must be white, that it must not interfere too seriously with the judging of color values. Hence a slavish imitation of the firefly, a mere striving after a cheap and efficient light without regard to æsthetic requirements will be fruitless. It seems inevitable, that for this reason alone, heat must always be an attendant of light.

The Embroidery of Knowledge

ONLY one who has lived much among old books realizes the æsthetic poverty of contemporary scholarship compared with the scholarship of some generations ago. Two criteria appear to be all-sufficient in determining what we shall learn nowadays, whether in or out of school. First, is it useful? Second, is it true? Once there was a third: Is it beautiful? Or, to express more completely the ideals of our grandfathers: Is it picturesque, piquant, romantic, colorful, spiritually enriching?

As to what constitutes utility, opinions will always differ, but between truth and falsehood the line is sharply drawn. Now, the ultimate criterion being the happiness of the human race, is there not much untruth that is worth while? In all ages there have been ascetic schools of thought that returned a formal negative to this inquiry, and modern pedagogy appears to have tended toward the same view.

More years ago than we care to specify, we learned the constellations. Even then the fashion of putting mythological figures on the star-maps—and *a fortiori* of teaching mythology along with astronomy—was on the wane; but by a chance, for which we have never ceased to be thankful, old Burritt fell into our hands. We learned the stars—and how much besides! How much, moreover—and this is the point we are aiming at—of which the modern youth commonly learns nothing. All mere embroidery, if you like—but how beautiful, how entrancing, how well worth cherishing through life! Old Orion brandishing his club at the Bull; the mild Bear sedately pacing around the pole, careless of the Hunting Dogs at his heels; the jeweled locks of Berenice; the Swan soaring down the Galaxy; and all the rest of that splendid company that still, for us, peoples the nightly sky, but is invisible to many astronomers who know a great deal about Besselian numbers and other "true" and "useful" things. Of course, one can and does learn mythology without the stars—whether from the fountain-head in Homer and Hesiod and Ovid, or from some short-cut of modern devising—but how much the myths and the stars enhance each others' charms, and how much the world is losing in their conjoined spell!

And so of the flowers; their legendry, their embroidery, is even more conspicuously neglected than that of the stars. What modern teacher of botany thinks it necessary or expedient to instruct his classes in the history of herb-lore—to show them copies of the old herbals—to explain the quaint doctrine of "signatures"? What does the youth of to-day know of the curious beliefs enshrined in scores of familiar plant-names? To be sure, such knowledge, like a knowledge of star-lore, is absolutely essential to an understanding of thousands of allusions in world-literature—in Shakespeare, Dante, Tennyson, Rostand—and hence to a full enjoyment of such literature; but apparently this fact does not make it "useful" according to Philistine modern standards.

As to history, happy is he who learned picturesque fables along with sober truths from Goldsmith's histories of Greece and Rome. We fear hardly a schoolboy of the present generation (apart from the dwindling few who still read Plutarch) can tell who it was that said, on a certain memorable occasion, "Strike, but hear me!" or has ever so much as heard what answer Leonidas made to the Persian monarch when summoned to deliver up the Spartan arms at Thermopylæ.

You who know only jejune, matter-of-fact modern textbooks and reference books—spend an afternoon in some old library, with Rees's Cyclopædia and the Oxford; with Lempriere's Classical Dictionary ("readable if not very trustworthy" the Britannica calls it); with a score of old books on "natural history" and "natural philosophy;" and, above all, with some files of the old periodicals. You cannot fail to be impressed with the fact that, with all its intellectual and material gains, scholarship has lost much in grace and distinction and humanity. What is more remarkable—and here is a hint for the practical and prosaic reader—these old books contain an astonishing amount of substantial and authentic information that has, somehow, dropped out of sight in the hurly-burly of "progress."

Hereditary Effect of X-Rays

EXPERIMENTS in applying X-rays to the ovaries of animals show that these are extremely sensitive to the rays, and are modified more strongly than is seen in any other tissue. Recent researches made by M. Fraenkel in Germany appear to show that such modifications are transmitted to the next generation, so that we have a transmission of acquired qualities in this case. He applied the rays for half an hour upon a four-day old female guinea pig, and found that in the subsequent growth of the animal the development in size and weight are strikingly lessened as compared to check specimens, 570 grammes as against 725 at the age of 10 weeks. However, the reproductive faculty is not diminished, and the female gave birth (after the normal period of 9 weeks) or at the age of 20 weeks, to three young, one dead and two living, but strange to say, the young had an extremely small size and kept a smaller size than normal during their growth. Again the reproductive power is not lessened. These animals were not exposed to the rays. The female having 7 inches length, gave birth to two young, one dead and the second of extreme weakness and needing a nursing bottle feeding. The mother also had a second litter of three young, but all very small, after which she could no longer reproduce, as the organs, altered by the X-rays, seemed to have their vitality exhausted.

Engineering

The New German Dreadnought "Grosser Kurfuerst" was launched at Hamburg on May 5th. This vessel is a sister-ship of the "Koenig," launched March 1st. The new dreadnought has a displacement of 27,000 tons, and will be armed with ten 14-inch guns.

Lipton's Challenge for "America's" Cup Accepted.—The challenge of Sir Thomas Lipton, of the Royal Ulster Yacht Club, has been accepted by the New York Yacht Club. The races are to take place under the New York Yacht Club's present rules of measurement, time allowance and racing, in September, 1914.

British Gun Record.—It is reported that the British super-dreadnought "King George V" has made a record of 39 hits out of 40 rounds fired with its 13.5-inch gun. The American record for big guns is held by the battleship "South Carolina," which in 1910 made 54 hits out of 57 shots with 12-inch guns. This is a record of 94.7 per cent, as against 97.5 per cent of the "King George V." No information as yet is available as to the range under which the British record was made.

Nine Years of Work on the Panama Canal.—A report has recently been published marking the completion of nine years of work at the Panama Canal under American jurisdiction. Little actual work was done for the first three years. Now 99 per cent of the concrete work has been completed, and only 20,000,000 cubic yards of dirt are still to be excavated. The total expenditure so far has been $290,110,000. Excavation is proceeding at the rate of 2,500,000 cubic yards per month.

To Deepen the Buttermilk Channel.—In order to provide adequate access to the New York Navy Yard, it has been decided to deepen the Buttermilk Channel between Governors Island and the Brooklyn shore to 40 feet, and increase its width to 1,000 feet. At present it is proposed to dredge it to a depth of 35 feet, which will cost $1,950,000. Later 5 feet more will be excavated, at a cost of $3,350,000. The reason for favoring this route, instead of the one now in use around the northwestern side of Governors Island, is that the latter would involve the removal of two rock ledges, which would be a difficult and dangerous task owing to the congested condition of shipping at this point. This deeper channel is called for by the increasing draft of our dreadnoughts.

Opening the Pacific End of the Panama Canal.—The dike south of the Miraflores lock, which has kept the waters of Ancon Harbor out of the Panama Canal during excavation, was destroyed by a blast of 32,750 pounds of dynamite on May 18th. This let the waters of the Pacific into the canal. It was originally planned to continue the excavation back of the dike with steam shovels, but as the dredges at the Pacific entrance had practically completed their work they were available for operation in the canal itself. The dike was accordingly destroyed to admit them. As excavation with dredges is more expeditious than steam-shovel work, this will make for increased progress. Although the canal will not be officially opened until January 1st, 1915, it is probable that ships will be able to make the passage through it early this fall. The only element of uncertainty is due to the slides at Culebra. Were it not for these slides there would now be only a million and a half cubic yards to be taken out of the cut instead of six and one half million cubic yards.

Naval Fire Control.—The daily press has been thrown into a high state of excitement over the theft, last March, of the fire-control plans of the dreadnought "Pennsylvania," believing that vital secrets have been stolen to be sold to a hostile power. Secretary Daniels' statement that these plans will be of practically no value to an enemy has failed to allay the excitement. The following reasons for considering the matter of trivial importance are given by Capt. William F. Sims, of the U. S. Navy, in a letter to the New York *Times:*

1. "As a matter of ordinary every-day common sense, there are no wholly essential fire-control instruments or wiring in any battleships in the world that are not below the protective deck, under water, and behind very heavy armor.

2. "All the exposed wires on the masts and elsewhere are aids to fire control, but are in no sense essential. They are for the purpose of facilitating and accelerating the transmission of orders, which orders can, however, be sent with nearly equal efficiency without them.

3. "The wires necessarily extend nearly the entire length of the vessel, so that there can be no special vital point for the enemy to attack.

4. "There are not, and never can be, marksmen possessing such supernatural powers as to be able (with such information) quickly to direct a shot that would disable a ship and make it impossible for her to direct her fire.

5. "Even supposing the marksmen to be entirely accurate in their aiming, and the fire-control officers to be equally accurate in their estimate of the distance, the speed and course of the enemy, the effect of wind, etc., there are no guns (including the powder, shell, rigidity of mount, accuracy of sights, etc.) capable of performing such a miracle of precision in shooting at battle ranges, that is, at distances of from five to six statute miles."

Electricity

Power Plants on the Weser.—Quite an extensive scheme is on foot to use water-power from the Weser and other streams so as to operate three electric stations and distribute current over an area of 2,500 square miles, reaching a population of 600,000. The total cost of the enterprise figures at $2,000,000 and over. Dams are to be erected across the streams at Eder, Münden, and Helminghausen for supplying the three turbine plants at these points, and all these plants together with their substations will be inter-connected upon the same network of power lines.

Turning a Sewer Into a Passenger Subway.—A somewhat unique example of "subway" electric line is found in the Paris sewers. Here the tunnels are of unusually large size and, as is well known, they afford a considerable passageway, carrying large water and gas piping on roof and sides as well as electric cables of various kinds. A recent idea has been to install a small electric road in one part of the tunnel so as to carry men and material. The miniature cars are drawn by a front motor car which works by a trolley from a pair of wires run along the ceiling, and quite a train of the small cars is taken in this way.

Electrification of the Berlin City Belt.—The Prussian Minister of Public Works, Herr von Breitenbach, expresses himself in favor of the proposed electrification of the Berlin city belt and suburban railways, for the traffic has now doubled on these lines within the last twenty years, and steam traction is no longer adequate to handle the traffic. Electric drive would give practically double the number of trains per hour, besides securing all the well-known advantages of the electric system. The Prussian parliament recently voted a credit of $5,000,000 for carrying on preparatory work upon this important scheme.

Railroad Time by Wireless.—The North Railroad Company of France uses the Eiffel Tower wireless time signals in setting its station clocks at Amiens and Boulogne and the important center of Rouen. The new system is superior to that of the telegraph, besides it does not temporarily monopolize telegraph lines. Each day at 10:45 A. M. the employee at the small wireless post of the depot receives the tower signal and regulates his clock accordingly. From this clock the other clocks on the premises are regulated. A new portable wireless receiver contained in a small box is specially designed for taking the tower signals; two wires stretched between telegraph poles serve as antennæ.

Explosion of a Generator.—From some unknown cause, the dynamo of a steam-turbine group blew up in the Essen station and made considerable havoc on the premises. The group in question consisted of a Zoelly steam turbine working at 1,000 revolutions per minute and direct coupled to a 5,000-kilowatt alternator. The whole machine burst, throwing pieces in all directions; one piece weighing several tons went through the wall and damaged an adjoining building. Other heavy pieces of 2,000 pounds weight were thrown through the roof, while the dynamo room was scattered with fragments. All the damage appears to have been done to the buildings and not to the machines of the plant. No one was injured, fortunately.

Stephen Dudley Field, known as the "father of the trolley," died at his home in Stockbridge, Mass., on May 18th, at the age of 67. He was the nephew of Cyrus W. Field, who laid the first Atlantic cable. His first work with the electric car was in 1880 when he built an experimental line on his own grounds in Stockbridge. His car took current from a central third rail. He also took out patents on conduit and trolley systems. One of his earliest inventions was the hotel annunciator, the first one of which was installed in the Palace Hotel, San Francisco, in the early sixties. In 1874 he produced the multiple call district telegraph box, and in 1879 created a revolution in telegraphy by the introduction of the dynamo. The following year he developed the dynamo quadruplex telegraph, and in 1909 he applied his system to the cable between Key West and Havana. He was also active as a pioneer in long-distance telephony and electric lighting.

"Electrokali," a New Artificial Potash Fertilizer.—A Swedish electro-metallurgist, Axel Lindblad, one of the constructors of the Trolhaetten furnaces for the manufacture of nitrates, has just succeeded in producing a new potassic fertilizer which is capable of replacing the Stassfurt salts which are at present imported into Sweden at an annual cost of about $2,000,000. It is obtained by treating feldspar or some other mineral having a potash base in an electric furnace, together with suitable quantities of carbon and iron. The resultant products are ferro-silicium, which can be used in steel works and foundries, and a potassic scoria which is readily soluble in water. To prepare the latter for use it is only needful to crush it in a suitable mill and there sift it. Experiment proves that it is readily assimilable in all soils. It possesses the advantage over Stassfurt salts that it contains no chlorides, which are said to be injurious in some soils. It is also recommended for use in the manufacture of salts of potassium and aluminium.

Aeronautics

A Record Altitude Flight with Six Passengers.—On May 8th, at Chartres, France, aviator Frangeois carried six passengers in his biplane for an hour and a quarter in a Savary biplane. During the flight he rose to an elevation of 2,300 feet, which is a far greater height than has been reached before by a machine carrying this number of passengers. The duration of the flight also constitutes a new record.

A New Flying Boat Record by Naval Aviators.—On the 9th inst., a new endurance record above water, when flying from point to point, was made by Lieut. J. H. Towers and Ensign G. de C. Chevalier in a Curtiss flying boat. Starting from Washington, they followed the Potomac River and Chesapeake Bay to Annapolis, 169 miles away. Three hours and five minutes were consumed in making this flight and the machine was kept at an average altitude of 1,500 feet.

A Flight with Passenger from Bremen to London.—On Sunday, the 11th inst., M. Brindejonc des Moulinais flew from Bremen to London—a distance of about 450 miles—at a high speed. He left Bremen at 8:40 A. M. on May 9th, and flew to Calais. The flight from the French port was made on the afternoon of May 11th. M. des Moulinais rose to a height of 5,000 feet and crossed the Channel in twenty minutes, which is a record. From Dover to London he maintained a height of 3,000 feet. He flew directly over the city, despite the regulations to the contrary, and landed at Hendon aerodrome at 3 P. M., thus again demonstrating the facility with which one can travel by aeroplane from country to country, despite all rules and regulations forbidding this. A few days later M. des Moulinais was haled to court and fined for having flown over London.

A Record Flight Across the Alps.—For the third time the Alps were crossed on the 13th inst. by an aeroplane. In this case, however, it was the Bernese Alps which were flown over by Oscar Bider, the Swiss aviator, in his monoplane. Starting from Obersinnental in the canton of Berne, Switzerland, Bider circled about until he reached a high elevation and then flew directly across the Rawil Pass at a height of 3,200 meters (10,498 feet). He was two and one quarter hours flying the fifty miles to Sitten, which is in the canton of Valais. Practically the entire flight was above the snow-covered mountains and glaciers and Bider was so cold and exhausted at the finish that friends had to lift him from his machine. The entire flight, including the alighting at the end, was made without any mishap.

An Oversea Aeroplane Race from Key West to Havana.—For a prize of $10,000 offered by the Cuban government, two Cuban aviators attempted to fly from Key West to Havana, a distance of about 100 miles, on May 17th. Despite a strong wind, Domingo Rosillo started at 6:35 A. M. in a Moisant monoplane and successfully accomplished the flight in an hour and a half. He then flew over the city for another quarter of an hour before he alighted. His machine was not provided with floats, and the flight was one of the most daring ever reported. A Cuban cruiser and two gunboats patrolled the course and were stationed some twenty-five miles apart. Rosillo's competitor, Augustine Paria, was unable to start in his Curtiss hydro-aeroplane because of some damage to the machine, but two days later he also made the flight successfully and won thereby a second prize of $5,000. These flights appear to give promise of a successful long-distance transatlantic flight by having stationed, on a designated line of latitude, about three hundred miles apart, a series of floating relief stations, in communication by wireless telegraphy, by which the progress of such a flight could be reported and succor given in case of accident.

A Somersault in the Air.—An occurrence which seems incredible, but which is vouched for by three prominent French officers, is recounted in *Aeronautics.* This is nothing more or less than a somersault in the air which befell Capt. Aubry when flying a Deperdussin for the purpose of effecting a reconnaissance over the region of Villerupt. "I was returning after a 35-minute flight," the Captain assures us, "facing a wind of about twenty-two miles per hour. My altitude was about 2,500 feet. At the moment of descent a series of violent gusts struck the machine, and on throttling down and switching off, I was obliged to dive in order to make the controls effective. As I dipped the nose of the machine, a couple of quick, successive gusts struck the top of the main planes and placed me in a vertical position. While endeavoring to manipulate the elevator, I found the machine had taken me in a perfectly vertical chute to less than 1,500 feet. It here adopted a horizontal attitude upside down and proceeded to effect a tail-first *vol plané.*" Somehow the pilot retained his seat. Continuing, he says, "The machine then gradually took up the vertical position again, describing a gigantic 'S' while doing so. Flattening out, I flew to a spot about two miles distant."

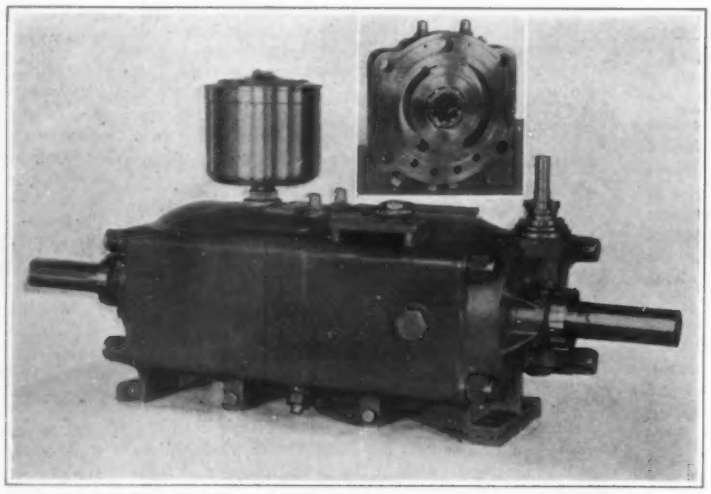
A Hydraulic Variable Speed Gear

A Power Transmission Mechanism Consisting of a Pump and Engine Couple

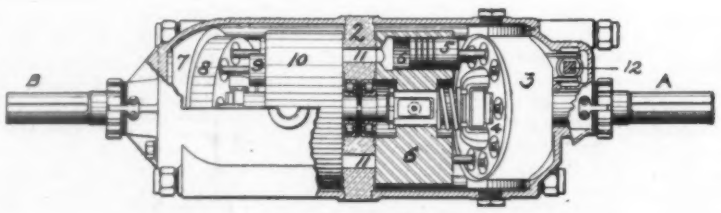
SEVERAL years ago a new type of speed gear was experimentally installed on one of our battleships for controlling the elevation of a 12-inch gun. The gear proved so successful that now more than five hundred of these machines are being used by the United States Navy. For a while the speed gear was kept quiet, but eventually the news leaked out, and the machines were sought by European powers as well. Now they are being built in England, France, Russia, Italy and Japan. Broadly, the gear consists of two main parts; an oil pump, and an oil engine operated by the fluid set in motion by the pump. The speed of the oil pump is constant, but the stroke of its pistons may be varied at will, thus varying the flow of oil to the engine and correspondingly varying the speed of the oil engine. The stroke of the piston is varied by operating a control shaft, and because the fluid used is practically incompressible and the leakage between pump and engine is on the average 13/100 of one per cent, the speed ratio between the pump and engine is positive and definitely determined by the angular position of the control shaft regardless of the amount of power that is being transmitted.

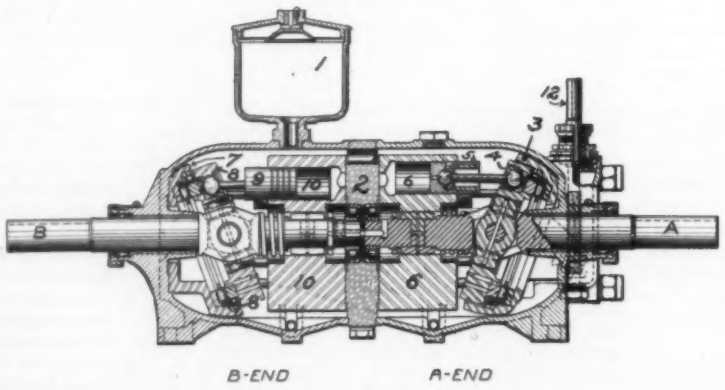
The operation of the gear may be understood by referring to the accompanying line drawings showing a sectional plan and a sectional elevation of the gear. The pump end of the gear is marked with the letter *A*, while the engine end is marked *B*. Accordingly, the *A* shaft is the driving shaft, while the driven shaft *B* is at the opposite end. The entire gear is inclosed in an oil-tight casing, and is provided with an oil expansion box 1. Within the casing two chambers are formed by a partition 2, known as a valve plate. At the *A* end of the casing is a tilting box 3, in which is mounted a socket ring 4. The box 3 does not revolve, but serves as a guide for the ring 4, giving it a wabbling or gyratory motion as it is carried around by the shaft *A*. The amount of the gyration can be varied by tilting the box 3. A series of nine pistons 5 are connected to the socket ring 4 and are made to play in and out of the cylinders 6, as the ring 4 gyrates. Of course the cylinder barrel 6 revolves with the shaft *A*. It will be evident that the stroke of the pistons 5 will depend upon the angle of inclination of the box 3. If the plane of the box is normal to the shaft *A* there will be no gyration of the ring 4, and consequently no reciprocation of the pistons, and if the box is tilted past the normal the pumping will be reversed.

The engine mechanism at the opposite end of the gear is quite similar to the pumping mechanism; except that in place of a tilting box there is a box 7 set at a fixed angle equal to the maximum angle of inclination of the box 3. Mounted to turn in the box 7 is a socket ring 8, connecting with a series of pistons 5, that operate in the cylinders 10. The cylinders 10 at the pumping end are supplied with oil from the cylinders 6, through ports 11 in the valve plate 2. It will be evident that as half of the pistons 5 are moving inward, the other half are moving outward, so that when the gear is transmitting power one of the passages 11 is under pressure, while the other is in suction. If the angle of inclination of the box 3 is equal to that of the box 7, the engine cylinders 10 will be filled and emptied at a single stroke of the opposite pump pistons 5. As the engine cylinders are filled and emptied their pistons 9 are reciprocated, and as they push the inclined ring 8 against the box 7 cause the ring to revolve and carry with it the shaft *B*. Thus the power transmitted from the *A* to the *B* shaft will undergo no change of speed. However, as the control shaft 12 is operated to tilt the box 3 more and more toward the vertical position, the stroke of the pistons 5 will be reduced and it will take more than one stroke of a piston operated, the box 3 will be oppositely inclined and the pistons 5 will again begin to reciprocate, but those which were formerly moving inward at one side will now be moving outward. So that the port 11, which was formerly under compression, will now be under suction, and *vice versa*. This will result in reversing the motion of the shaft *B*. The oil within the casing of the gear is under no pressure, but merely serves to lubricate the parts. The only pressure is that which exists between the pump and engine cylinders, and the design is such that there is practically no leakage between the cylinder barrels and the valve plate 2 except enough to provide a lubricating film. The socket rings 4 and 8 are mounted on roller bearings in their respective boxes 3 and 7, so that the gear is practically frictionless.

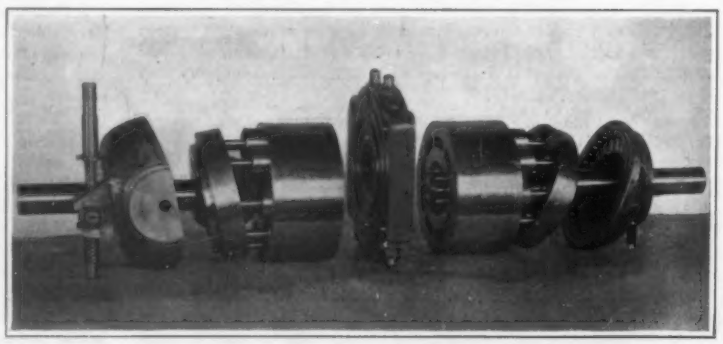


General view of the hydraulic variable speed gear. The central valve plate is shown in the insert.





Mechanical details of the hydraulic speed gear.



The speed gear taken apart. The control shaft shown at the left.

The method of controlling the inclination of the box 3 by means of the control shaft 12 is illustrated in the photograph, which shows the parts of the gear removed from the casing and separated. The box 3 is formed with an arm which carries a sliding nut engaging a threaded extension of the control shaft 12. Turning the shaft 12 results in moving this arm up or down, and thereby tilting the box 3, which has pivotal connection with the casing.

The chief advantage of this type of transmission is its great flexibility. The *B* shaft may be started under a dead load of any magnitude within the strength limits of the machine, without any fear of overloading the motor or source of power; the speed may then be increased gradually and positively to its maximum without steps or abrupt gradations. Its remarkable flexibility must necessarily give wide differences of efficiency. Under the best conditions efficiencies ranging from 85 per cent to 91 per cent are common; under average working conditions the efficiencies vary between 80 and 85 per cent; under small loads and low speeds of the *B* shaft the efficiencies range from 80 per cent down to 50 per cent or less. Of course at a zero speed the horse-power efficiency must be zero per cent, while the torque efficiency remains at 95 per cent, and so the horse-power efficiencies have a wide range from zero per cent to 91 per cent, while the torque efficiencies throughout the whole range remain between 90 per cent and 96 per cent.

Aside from turret and gun control on battleships these hydraulic gears have been applied to automobiles, tram cars, drawbridges, cranes, hoists, machine tools, and the propelling of vessels. Indeed, the field of application seems as wide as the transmission of power at variable speeds.

Preserving Cut Flowers

MODERN research in France has developed the art of preserving cut flowers to a point undreamed of a few years ago. The old way was to cut off the end of the flower stem or sear it or add salt water. Fourton and Ducomet applied the principles of osmotic pressure to the subject. They reasoned that when flowers containing salts in their juices were placed in pure water, the unequal pressure thereby developed ruptured the cell walls and made the plant wilt. Consequently they tried a great number of solutions for preserving the cut flowers and found that when the osmotic pressure of the solution outside equaled that of the juices in the flower, the best results were obtained.

Sugar solutions of varying strength proved the most effective except in the case of lilies, lilacs and sweet peas. Carnations lasted longest in a fifteen per cent sugar solution, while roses were most permanent in a sugar solution of half that strength. Chrysanthemums and tulips are not benefited, but effort is being made to discover a suitable preservative for them also. Although lilacs are not benefited by a sugar solution only, yet if they are kept in a twelve per cent sugar solution which also contains one hundredth of one per cent manganese sulphate, they last much longer than usual and improve in tint. One of the United States experiment stations has begun experiments in this line and new results are expected.

Fig. 1.—A three-lamp projecting apparatus.

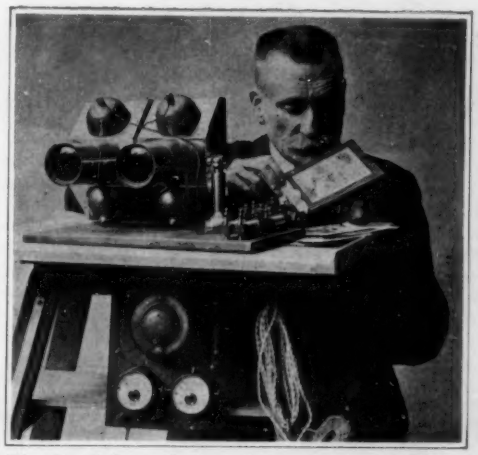


Fig. 2.—A home lantern for projecting dissolving views without shutters.

Dussaud's "Cold Light"

Its Remarkable Applications

By Jacques Boyer

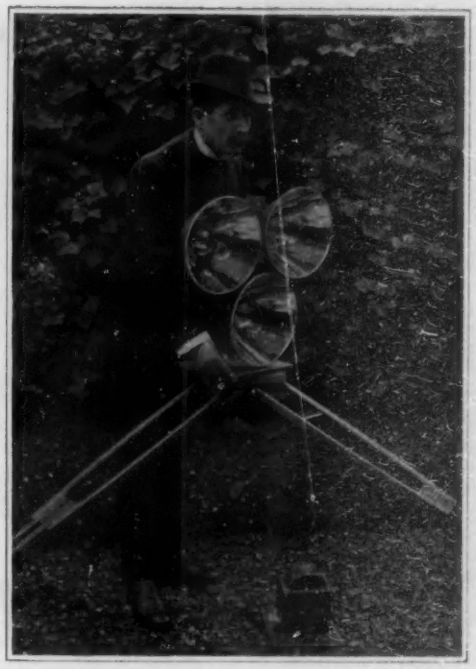


Fig. 3.—A searchlight to be used by firemen.

THE accompanying photographs are probably the first illustrations of the apparatus which has been invented by Prof. C. F. Dussaud, to produce what he calls "cold light." In a sense, the term "cold light" is not absolutely correct. Heat is necessary to produce light in Dussaud's apparatus, as it is in every other lamp, but the term is justified in so far as Dussaud's lamps radiate a negligible quantity of heat.

How this paradoxical result is obtained will be clear if we refer to the accompanying diagrams (Figs. 6*a* and 6*b*). The Dussaud system consists essentially of a series of tungsten-filament lamps *e*, mounted near the periphery of a wheel or disk composed of any suitable insulating substance and carried on an electrically insulated shaft a^1 turning in a support *b*. A metallic pulley *c* is mounted on this electrically insulated shaft a^1, and the pulley is connected by a belt c^1 with a crank or a small electric motor *d*. Each of the bulbs is fitted into a socket *f* secured on the disk and communicating with one of its poles, the other terminal being connected with the lamp-base f^1. The end of each lamp-base f^1 engages a metallic ring *g*, mounted on the rear of the disk *a*, and connected by bars *h* with a plate h^1, adjacent to the metallic pulley *c*, against which a commutator brush *i* contacts, the brush being connected with one of the poles of the source of electricity. The other pole communicates with a commutator brush *j*, the contact point of which lies in the circumference of the circle described by the sockets *f*.

As the disk *a* is rotated by the motor *d*, all the lamps *e* are successively and intermittently lighted when they touch the commutator *j*, and are successively extinguished as soon as they leave it. As soon as one lamp moves away and is extinguished, another immediately takes its place and is illuminated, the retinal persistence of the intermittent flashes giving the effect of a steady light. Each lamp is supplied with current for such a very brief interval that the slight amount of heat to which it is subjected is very quickly dissipated. The cooling interval is about double that of the light interval.

Dussaud has found that with this apparatus it is possible to "overvolt" his lamps; that is, he can impress upon them a voltage from two to four times above their normal. Hence the efficiency of the lamps is greatly increased and a very much more intense light is obtained from a given filament. The effect of overvolting is remarkable. In a paper read before the Academy of Sciences by Branly, it is stated that with 50 to 160 watts applied to 16 lamps of 25 to 80 candles, Dussaud has respectively obtained 250 to 800 candles of cold light for several hours.

As our illustrations show, Dussaud employs an optical system with his lamps, in other words, either lenses or mirrors. The result is that while the heat effect of the electric current is dissipated over a great area, the luminous rays are concentrated in a very small point or space.

The tungsten lamps employed are of Dussaud's own design. Some of them are only 0.8 to 1.6 inches in radius. Groups of three are used in some models. They are successively flashed in the focus of a condensing lens, without breaking down the filament or blackening the bulb. Indeed, it is said that the results produced are identical with those obtained with an electric arc ten times more intense.

Dussaud's new light is particularly adaptable for use in situations where great luminosity must be obtained with a feeble current. These conditions, for example, are those which manufacturers of moving picture projectors have long tried to realize. Dussaud has shown that it is possible to project moving pictures on a sheet five yards square with an electrogenerating apparatus of 150 watts, in

(Concluded on page 501.)

Fig. 4.—A photograph of an interior taken by Dussaud's cold light.

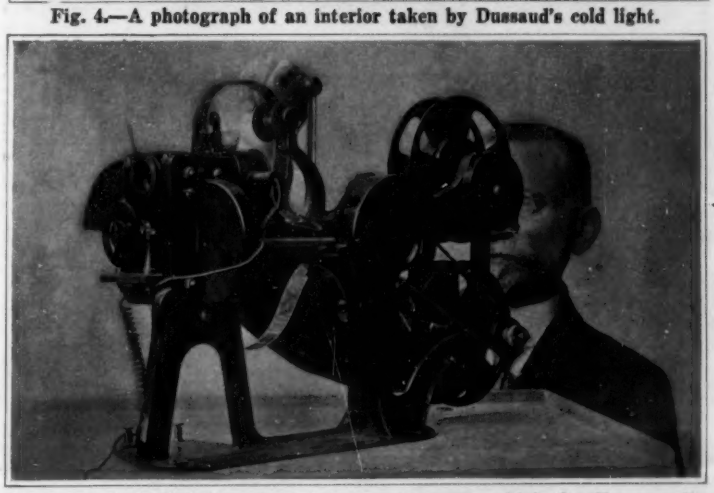
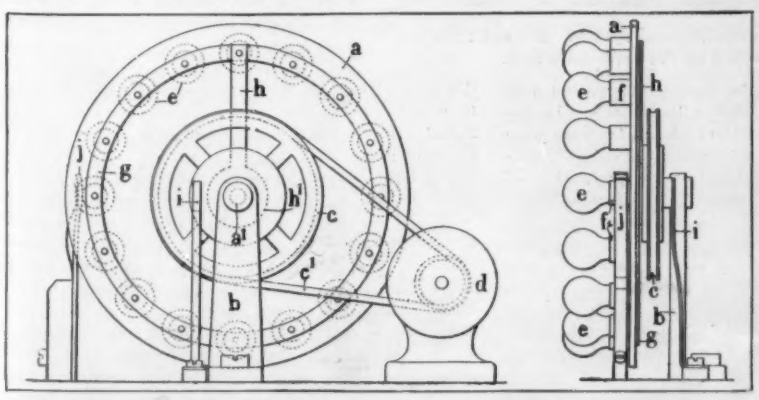


Fig. 5.—A "cold light" moving picture projector, in which the film may be stopped without danger of ignition.



Figs. 6a and 6b.—Front and side elevations of Dussaud's 16-lamp machine.

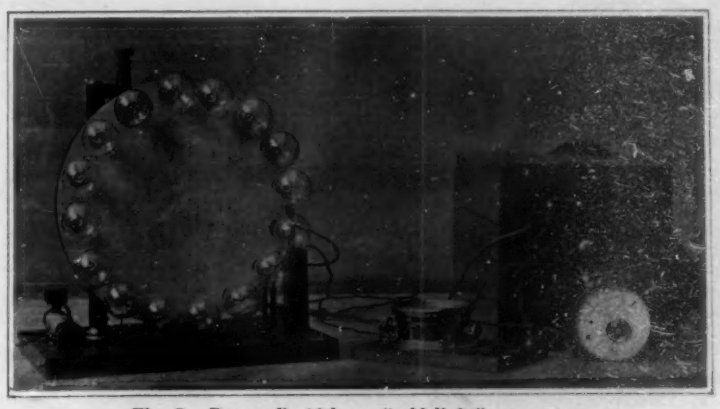


Fig. 7.—Dussaud's 16-lamp "cold light" apparatus.

Plans for the Disposal of New York's Sewage

A Treatment Plant on an Artificial Island Three Miles Offshore

LOOKING out of the window of his office in the Whitehall Building, Dr. George A. Soper, president of the Metropolitan Sewerage Commission of New York, recently saw a man filling a barrel with water from the North River at the Battery. Sending one of his men out to learn what use was to be made of this water, he received the startling information that it was to be sent to a town in Vermont to furnish sea baths for a sick baby whose parents could not afford to take it to the seashore as directed by the family physician. The man was astonished to learn that his barrel was filled not with sea water, but with *sewage!* With many other people in this city, he shared the notion that all salt water is proof against disease, and that even though the waters about New York may not appear very clean, they are perfectly harmless. Yet it has been demonstrated that typhoid germs live in salt water just as long as in fresh. They have actually been found to live in oysters for forty-three days, or as long as the shellfish could be kept alive.

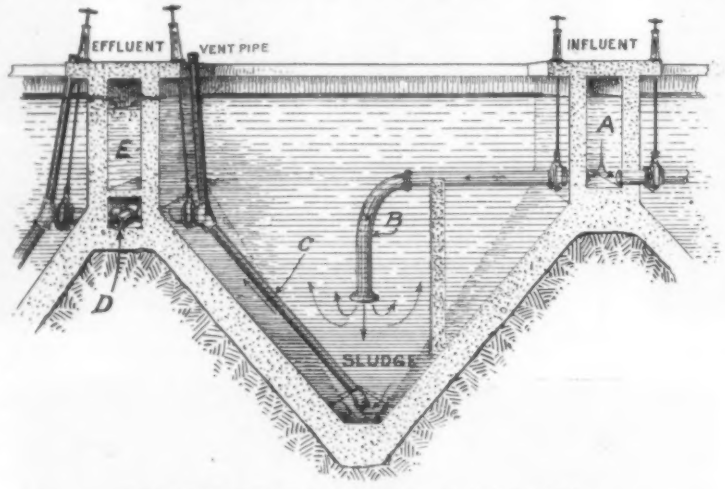
Popular ignorance on questions of sewage and on the dangerous condition of New York Harbor is appalling. Free baths are used which in many places have been placed almost at the very mouths of large sewers. Many a bather has become ill through diseases caught from the filthy waters. In order to show how sewage water finds its way into these bathing places strong dyes were recently placed in a sewer, and before long the waters of an adjacent municipal bath were so reddened as greatly to alarm bathers. The very first thing a bather does is to duck his head under and take in a mouthful of the water, in that way exposing himself to all imaginable forms of disease germs that infest these bathing places. Exactly how much sickness results is difficult to determine, for the reason that those who patronize the baths live in disease-infested environments, but the municipal authorities are now awake to the dangers and are considering plans for floating baths in which Croton water or filtered sea water will be used.

There is no doubt that our ignorance of sewage conditions is due mainly to the fact that the subject is not a pleasant one to investigate. But conditions have grown so bad in this vicinity that the matter has been forced upon us. Several years ago the Legislature of New York State directed the city to appoint a commission to investigate the problem confronting New York city, and offer suggestions as to the disposal of the city's sewage. The members of this commission, who were selected by Mayor McClellan and reappointed by Mayor Gaynor, are particularly suited to the work.

George A. Soper, the president, is a civil engineer, who has also had wide experience in the management of epidemics. He is one of the few American members of the British Royal Sanitary Institute. He recently made an exhaustive study of subway ventilation and suggested many improvements that have been adopted and are now in service. Three other members of the commission are also engineers: James H. Fuertes, a man of international reputation on questions of sewage disposal and water purification; Charles Sooysmith, father of caisson building-foundation; H. de B. Parsons, Professor Emeritus of Practical Engineering at the Rensselaer Polytechnical School, Troy, N. Y. The fifth member, Linsly R. Williams, is a physician of wide reputation, who is considered for State Commissioner of Health.

The work of this representative body, while not yet complete, has been disclosed in a number of preliminary reports which indicate that the problem has received a very careful and thorough study. Their findings are entirely impartial, and their suggestions are perfectly feasible from the engineering and sanitary standpoint. Their conclusions have been reached only after examining into the methods of handling the sewerage problem in other cities in America and in Europe, and consulting with eminent foreign experts in the fields of Chemistry, Engineering, Biology and Hygiene.

In their investigation of New York city conditions they found that the Harlem and the lower East River presented the worst conditions. Into the East River, in 1910, two hundred and sixty-four million gallons of sewage emptied every twenty-four hours. The sewage came from territories in Manhattan, Queens, and Brooklyn, populated by 2,058,000 individuals. In the narrow Harlem River 99,000,000 gallons of sewage were received daily. The North River received only 132,000,000 gallons of sewage daily from a population of 726,000 in Manhattan and 283,000 in New Jersey, the latter contributing 34,000,000. It is possible that the very fact of our calling these bodies of water "rivers," has led to the impression that they can handle any amount of sewage easily. The Harlem River is not a river, but merely a strait connecting the North and the East rivers. There is no actual flow in this strait except that produced by the tide. The East River is in no sense a river, but merely an arm of the sea, while even in the North River there is little flow except that due to the tides. In order to study the direction and character of currents in New York Harbor, floats have been placed in various localities and records of their movements have been kept. One of these floats placed in the East River traveled in 78.5 hours 107.79 miles, at the end of which time it was picked up only a mile from the starting point. It serves to illustrate how sewage is carried back and forth by the river with little prospect of being carried out to sea. Every year the Department of Docks and Ferries dredges out about 400,000 cubic yards of deposits from the slips and docks of the lower East River, while in addition to this, large quantities are also dredged by private enterprise. One of the worst points in this section is Newtown Creek, which probably holds the world's record for filth. In Wallabout Bay a nine-foot sewer empties at the bulkhead line, in water that is so sheltered from the currents of the East River, that there can be no satisfactory dispersion of sewage. Even worse conditions are found outside of the lower East River section in Gowanus Canal, whose waters are black with filth, for the reason that nine sewers empty into the blind channel. In the hope of improving the canal a tunnel has been built, connecting it with the upper bay, through which the sewage water is pumped from time to time, but this has had little effect upon the canal and has not bettered matters, for the reason that the waters of the upper bay are already charged with far more sewage than they can take care of.



Section through one of the proposed settling tanks.

Map showing New York's proposed sewage disposal system. Sewage from the shaded territory will be carried to the artificial island.

In considering the sewage problem of New York, it was found necessary to divide the city into sections, as indicated in the accompanying map. Tentatively, it is proposed that the sewage pouring out of Manhattan into the Hudson River be treated for the removal of solids and grease and then be allowed to discharge into the stream. The solids would have to be collected at some central point and burned, unless some use for the material was found. Similarly, the sewage from Richmond and from that part of Brooklyn facing the upper bay as well as from certain portions of the Bronx and Queens would be treated for the removal of solids. The most serious points, however, were the Harlem River and the lower East River. To take care of the sewage now emptying into the Harlem River, it is proposed that a sewage disposal plant be built on Ward's Island, which would receive all the sewage coming from the Bronx and the upper eastern side of Manhattan. The sewage here could be treated for the removal of the solids, the liquid emptied into the upper East River, and the sludge carried off to sea in tank steamers. Another plant could be placed at Tallman's Island.

For the lower East River a plan has been proposed which at a first view may seem rather daring. It calls for the construction of an interceptor taking in the sewage from the lower east side of Manhattan, dipping under the East River, joining an interceptor on the Brooklyn shore and then passing on out under the lower bay to an artificial island built three miles offshore. This line would take most of the sewage now emptying into the East River, and just before reaching the lower bay it would receive the sewage from the vicinity of Jamaica Bay. The tunnel would pass out to sea at a depth of about sixty feet.

The outlet island would be built on a shoal, which, judging from the surveys of the past sixty or seventy years, is practically permanent. There are no insuperable difficulties in the way of building the island, there are no engineering difficulties in the way of building a tunnel from the main line to the island, or of constructing the siphon under the East River, and there are no sanitary obstacles that present themselves in the disposal of the sewage on the outlet island. Everything about the proposed plan is based upon prac-

(Continued on page 501.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Electrical Auctioneer

To the Editor of the SCIENTIFIC AMERICAN:

In consequence of an article in your issue of April 26th, page 371, on the "Electrical Auctioneer in Holland," I beg to inform you, that this system has been in application for several years in the auctions of vegetables at Delft and at Loosduiner near The Hague, and with excellent results. It is perhaps known to you that these environs supply Berlin with vegetables.

The Hague. A. LUKKIEN.

The Dangerous Position of Aeroplane Motors

To the Editor of the SCIENTIFIC AMERICAN:

The sad and unnecessary death of Lieut. Park in an army biplane near Los Angeles on May 9th, brings those interested in aviation face to face once more with a fatal error in design which places the motor behind or beside the pilot's seat in an aeroplane. This error has caused a large share of the prejudice now existing among people; but they are not generally aware of the chief, the underlying cause of the deaths of several of the world's best aviators.

There are many cases so similar to that of Lieut. Park that a statement of the manner of his death will suffice to show that the placing of an engine in such a palpably dangerous position is little short of criminal. This is the opinion expressed by every aviator and mechanic with whom the writer has discussed the subject. It is a point which should be emphasized by the press and everyone interested in the future of aviation and the safety in design of flying machines of all types.

The writer has seen motors torn from beds to which they were often insecurely fastened and literally buried in the ground by their force of impact. The shock necessary to dislodge a two or three hundred pound mass of metal would, in many cases, be insufficient to bruise more than slightly the pilot of a machine were he not crushed by the motor. This has been demonstrated in many accidents to machines built with the heavy parts placed in front of the driver.

Hubert Latham was not even badly shaken up in a fall of a hundred and fifty feet which demolished a barbed wire fence, the landing chassis, propeller and one wing of his 1,400-pound Antoinette monoplane at the Los Angeles aviation meet in 1910, the day before Hoxsey was killed at the same meet. On the other hand, a well-known aviator told the writer of a fall in which he barely escaped death when his motor, placed a little to one side and at his rear, was dislodged and shot past him, making a hole two feet deep in a plowed field.

An eye witness of the accident to Lieut. Park says that the "tree" which wrecked his machine was only a bush, a fall from the top of which would probably not have injured anyone. The officer's head was horribly mangled by the heavy motor.

The flying machines of to-day are certainly an improvement over the earliest makes; but beyond a doubt they are faulty in many points. Many of these faults are difficult to remedy; but the problem of locating the motor is certainly very easy of solution. More attention should be given by all designers to placing the motor in aeroplanes in such a position as to give the pilot this one insurance of safety at least.

Will army engineers, in justice to the men who risk their lives for their country, alter the machines now in use and make the placing of the motor in front of the pilot one of the requirements for acceptance by the Government? This will cost little; surely not as much as the loss of men of Lieut. Park's caliber.

Pasadena, Cal. WOODWARD F. BARNWELL.

Battleship Protection for the Pacific Coast

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 12th, 1912, in an article on the last naval review in the Hudson River, the following appears:

"The great mobilization of the Atlantic fleet at New York, for inspection by the Secretary of the Navy and review by the President of the United States, is the largest and most important gathering in one place of the ships of the United States navy that has ever occurred. Last year ninety ships were mobilized at New York, whose total tonnage reached 576,634. To-day there are gathered in the Hudson River 123 ships of all classes, whose aggregate displacement is 720,486 tons That the people of New York and visitors from the various states will thus have under their eyes, at one and the same time, practically the whole fighting force of the United States navy, is shown by the fact that the latest official summary of the displacement of all the ships of the United States navy gives the total as 758,499 tons. So that the fleet at New York is only about 38,000 tons short of including the whole of the effective navy."

It may be rather late to quote the above from your October 12th issue, but since Secretary of State Bryan has made his hurried trip to California, it seems to us that the above facts are a great deal truer to-day than then. When you say, "the fleet at New York is only about 38,000 tons short of including the whole of the effective navy," we wonder where that 38,000 tons is. Does it include that one battleship that might have swelled the number to thirty-two at the review? It certainly does not include the six armored cruisers that compose the Pacific fleet, or the famous old "Oregon" (our one lonesome battleship on the entire Pacific Ocean), or the "Saratoga" (formerly the "New York"), the "Monterey" or "Monadnock" of the Asiatic station And let us add that the last two named vessels belong to the class that are used in gunnery experiments on the Atlantic side.

The thirty-one battleships that participated in the great review at New York carried a total of 122 12-inch and 13-inch guns The total number of 13-inch guns on the Pacific is eight, for since her rebuilding the "Oregon" carries eight 13-inch instead of the original four 13-inch and eight 8-inch The monitor "Monterey" mounts two 12-inch and two 10-inch guns, and the "Monadnock" four 10-inch guns. This is a total of eight 13-inch, two 12-inch, and six 10-inch guns afloat on the Pacific to-day, and each one of these ships is in reserve, and then, too, the guns are of old patterns and not to compare with those of the crack ships of the Atlantic fleet.

The effective fighting force on the Pacific consists of the six armored cruisers of the "California" class, of 13,680 tons displacement, which form the Pacific fleet, and the old armored cruiser "Saratoga," of 8,150 tons, of the Asiatic fleet The remaining vessels of these two fleets are cruisers and gunboats that are fit only for police duty. The "California" class mounts four 8-inch and fourteen 6-inch guns, the "Saratoga" four 8-inch and ten 5-inch, so it is easily seen that the heaviest gun in active service on the Pacific to-day is of 8-inch caliber, and only twenty-eight of them, compared to the total of 104 12-inch guns that are carried by the twenty ships of the Atlantic fleet.

As an argument for having a sufficient naval force on the Pacific, a comparison of the territory supposed to be guarded by the navy is interesting. On the Atlantic side draw a line from Maine to Porto Rico and the Panama Canal; on the Pacific this line would stretch from Panama on the south to Tutuila, Samoa, thence to Guam and the Philippine Islands, and back again to the vicinity of the Hawaiian Islands, from where it would go straight north to Alaska This experiment will give the uninformed an idea, of the vast amount of territory over which the two small fleets on the Pacific must hover as compared to that guarded by the Atlantic fleet

Mt. Vernon, Wash. R. E. BOWRON.

Recent Assaults Upon the Patent System: What They Mean to Manufacturers

PENDING in Congress to-day is a bill which cuts down from seventeen years to three years the most essential protection now afforded to manufacturing patent owners, and lays upon manufacturers of patented articles prohibitions and penalties in respect to the merchandizing of patented articles which, if imposed upon the merchandizing of articles generally, unpatented as well as patented, would never for a moment be tolerated in any commercial country in the world.

This bill cannot be disregarded as pure freak legislation. Reported favorably by the House Committee on Patents in the last Congress, and reintroduced in the present Congress by Chairman Oldfield of that committee, its possibilities of evil to small manufacturers, to independent inventors, and to their industrial research, experimentation and development, that alone keep America in the front rank of nations, constitute the most menacing cloud upon the business horizon.

The Oldfield bill proposes that if any applicant shall establish in a Federal District Court that a patent owner, who has purchased a patented invention from the original inventor, is withholding it "with the result of preventing any other person from using the patented process" more than three years after the patent is issued, the Court shall order the patent owner to grant to the applicant a license to use the invention upon such terms of royalty as the Court "deems just."

The burden of litigation which this proposal involves would give large corporations the greatest advantage over ordinary patent owners.

The excuse offered for this universal proscription of patents is that patents are sometimes "suppressed."

Thomas A. Edison has time and again declared that he never knew of a valuable invention being suppressed. For twenty-seven days the House Committee on Patents took testimony upon the Oldfield bill, and not a single case of "suppression" was cited. Almost unanimously the witnesses emphatically opposed the bill with conclusive proofs that its proposals were unwise.

If the small independent manufacturer could be compelled to license his big competitors to manufacture all the second and third best inventions that he has acquired, tested and laid aside in favor of his best invention, his big competitors, with their superior advantages of capital and selling organization, could soon crowd the smaller manufacturer, even with his superior invention, completely off the market.

Instead of preventing "suppression" of inventions, the Oldfield bill would really facilitate it.

The Oldfield bill proposes that whenever any patent has been used in connection with any combination in restraint of trade, the patent may be condemned and forfeited; and further that "such restraint shall be conclusively deemed to have been or to be unreasonable" and in violation of the Sherman law, if the vendor of any patented article does any of a number of acts. None of these acts are forbidden to manufacturers or dealers in *unpatented articles*. Only those who have spent their time and money advancing progress and the arts by developing and introducing new and useful inventions are subjected to this wholesale outlawry. But every manufacturer and dealer in *patented articles* becomes a criminal if he tries to secure a year's business as a condition of selling to a dealer; if he tries to hold the dealer to his agreement to buy his patented goods exclusively or to a certain extent; if he tries to hold the dealer to his agreement to maintain a standard price on the patented goods; if he licenses the use of a delicate patented machine on condition that it be used only with specially prepared supplies or in continuity with specially adapted machinery necessary to insure the perfect operation of the patented machine; if he limits the licensee's use of the patented machine to a particular line of business so that he may license to others the exclusive use of his patented machine in other lines of business; if he agrees with a retailer in a town to sell his patented goods to no one else in the same town or to sell to other retailers only on less favorable terms, in consideration of which the retailer shall push the sale of the goods; or if he sells his patented goods in any particular territory at a less price than he sells elsewhere.

The penalty for doing any of these things is the forfeiture of the patent, a fine of five thousand dollars and a year's imprisonment, and the payment of threefold damages and the costs of suit and attorneys' fees to anyone who comes in within three years thereafter and proves any damage. But manufacturers and dealers in every other form of property are left absolutely free to do any or all of these things.

In the closing days of the last Congress, members of the House Patent Committee, representing both parties, united in a minority report against the Oldfield bill. They showed that every evil for which the bill had been urged could be cured under existing laws, and that under the Sherman act interpreted by the Supreme Court in many recent decisions, the patent laws afford no protection to any form of restraint of trade. Thirty-five years ago, an assault upon the patent system, embodying proposals almost identical with those of the Oldfield bill, was defeated in the United States Senate. If American manufacturers and inventors, whose existence is now threatened by the Oldfield bill, join hands with the opponents of the Oldfield bill in Congress, the patent system can again be saved.—*Abstract of an address by Gilbert H. Montague of the New York Bar, delivered before the National Association of Manufacturers' annual convention, Detroit, Mich., May 21st, 1913.*

The Current Supplement

IN this week's issue of our SUPPLEMENT C. R. Darling describes some experiments with liquid globules and columns. Our readers will recall the very elegant experiments with very large spherical drops presented by the same author several weeks ago.—Prof. W. H. Bragg, in an article entitled "Radiations—Old and New," gives an excellent survey of the remarkable achievements in the recent investigations of corpuscular and other radiations.—Sidney Low discusses the birth rate in its relation to military armaments.—The cork industry is described and illustrated.—In an article "Evolution from the Standpoint of Physics," A. J. Lotka gives an exposition of the physical significance of the principle of the survival of the fittest, or, as it is stated in physical terms, the principle of the persistence of stable forms.—A very valuable article comes from the pen of Prof. E. Baur, on the subject of the production of electric power direct from coal. The problem appears to be well on the way toward solution.—Prof. J. P. Norton writes on that all important subject "The Changing Cost of Living," and gives us an account of comparative measurements made in this country and abroad.

A New Parseval Airship

By Walter Isendahl

THE Berlin Airship Company has constructed, at its Bitterfeld "shipyard," a new Parseval airship for a foreign government. The new vessel is the seventeenth Parseval airship, and consequently bears the provisional designation P. L. 17. It was built in the remarkably short period of two months.

The new airship, like its predecessors, is of the flexible type, but it exhibits many radical innovations which greatly alter even its external appearance. The envelope is slenderer than usual, and approximates to the form of a shark. It is girdled by numerous hoops, which distribute the weight of the car uniformly and give the envelope stiffness. The latter does not show the characteristic yellow color of Parseval airships, as its fabric is impregnated with aluminium, which gives the vessel a beautiful silvery appearance. There are two propellers, placed to the right and left of the car, and above it. Each propeller has four blades of elastic steel only 1/25 inch thick. The propellers are driven by two six-cylinder Maybach motors, which have an aggregate power of 300 to 320 horsepower. The speed of the new vessel, 41½ miles per hour, greatly surpasses that of any other Parseval airship and has heretofore been regarded as unattainable by non-rigid vessels of this size. In other respects, also, greatly increased efficiency has been obtained. The available ascensional force is about three tons, and fuel sufficient for a continuous flight of more than twenty hours can be carried. The official trial trip, *via* Koethen, Leipzig, Dessau, and Halle, occupied six hours. The foreign officers present were exceedingly well satisfied with this performance, and accepted the vessel for their government.

The Good Roads Movement

FOLLOWING the recent publication of the *Good Roads Year Book*, which presents the road situation in the United States to date, the American Highway Association has begun the issuance of a series of instructive papers presenting the most important phases of road improvement from the standpoint of both the layman and the engineer.

Among the first to be issued is a reprint of the address of W. W. Finley, president of the Southern Railway, at the recent American Road Congress on "Good Roads and the Cost of Living." Mr. Finley holds that the cost of living is largely an economic question and that efforts should be turned toward increasing the area of farm land under cultivation and increasing the yield of farm products per acre. He points to the well known fact that prospective farm settlers are largely governed by railroad and public road facilities, and that when these are not adequate, farm operations are discouraged.

"Increasing farm products by getting more people on to the land and by bringing a large area under more intense cultivation is largely a matter of transportation," said Mr. Finley.

Concerning public roads as feeders to railways, Mr. Finley says: "May it not be a fact that the transportation needs of many localities that seem to be waiting on railway construction would be met more satisfactorily and more comprehensively by a system of good roads connecting them with existing railways? The railway should be located with reference to the main traffic channels. It can no more take the place of the wagon road for the collection and distribution of traffic in a rural community than the wagon road can replace it as a main highway of commerce. Considered as parts of a general transportation system the railway and the wagon road supplement each other, and I believe that this relation should be recognized in the formulation of plans for road improvement."

Among other papers to be issued will be those which deal with the construction and maintenance of all types of road, the selection and testing of road materials, adequate accounting systems for the expenditure and safeguarding of road funds, the use of convict labor in road improvement, instruction in highway engineering in schools and colleges, the beautification of roadsides.

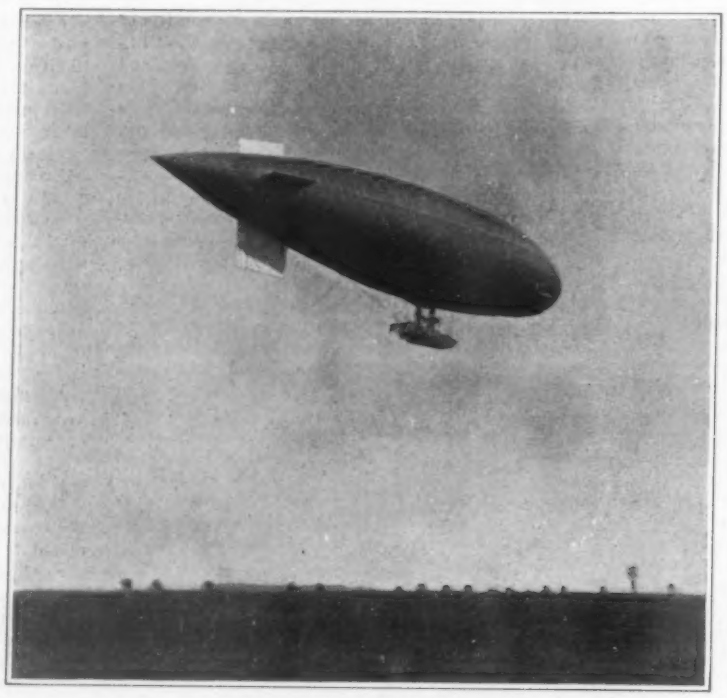
The American Highway Association is composed of upward of 2,000 of the leading men and women of the nation and is conducting a great campaign of good roads education and reform throughout the United States. Its president is Logan Waller Page, director United States Office of Public Roads, and its secretary is J. E. Pennypacker, former Chief of Road Management in the Department of Agriculture, and afterward Chief Statistician for the Joint Congressional Committee on Federal Aid in the Construction of Post Roads. The headquarters of the association are in the Colorado Building at Washington.

Stimulating Plants by Radium

VARIOUS methods of stimulating plants in a state of rest to resume growth have been successfully adopted, such as the ether treatment, the warm bath process, injections, etc. The brilliant plant physiologist, Prof. Hans Molisch, some of whose work has already been described in this journal, now announces his discovery that radium has a similar effect, causing twigs of various kinds to begin "budding" much earlier than is normally the case.

We find an abstract of his experiments in the *Naturwissenschaftliche Rundschau*. Herr Molisch made use both of the radium emanation and of radium salts inclosed in glass tubes or spread on metal plates. The tubes held radiumbariumchloride. The metal plate gave off strong α-rays, which were almost entirely absent from the glass tube because of the absorption. In the experiments with radium emanation, the rays from a flask filled with an aqueous solution of radium chloride passed into a cylindrical glass vessel which was the culture chamber. The twigs placed in this were exposed to a radium emanation ranging from 1.84 to 3.45 millicurie. Only the twigs of *Syringa vulgaris* were used in the former case, but various plants were exposed to the emanation. The terminal buds of the syringa, which were subjected to the influence of the radium preparations for one or two days in December or at the end of November, and then placed in ordinary light in a greenhouse, budded in a short time, while those not thus treated budded much later or not at all. When the radiation was not continued long enough no effect was visible. When too long continued the effect was inhibiting, injurious, or even fatal. The time chosen for the experiment is also important. In September and October, when the state of rest is firmly established, the radiation had no effect. In January or later, when the rest-period is already past, there is either no difference observed or else the twigs subjected to the rays seem slightly retarded. This is similar to the effect of the ether and warm bath treatments. The emanation had a more marked effect than the radium salts. This is because it influenced the plants more uniformly and from all sides. Other plants favorably influenced by the emanation were *Liriodendron tulipifera*, *Aesculus Hippocastanum*, *Staphylea pinnata*, and in some degree *Acer platanoides*.

The process is too costly for commercial use, but is of scientific importance in connection with recent investigations of the effect of narcotics on the chemical composition of resting parts of plants. On growing parts radium preparations of like strength have an entirely different effect, as Molisch hopes later to demonstrate.



A new Parseval airship.

A Number of Shock Absorber Patents.—Patents Nos. 1,058,410 to 1,058,414 have been issued to Walter H. Cook, of New Orleans, for shock absorbers which include cushioning elements in the form of a heavy rubber tube operating pneumatically between certain parts where it is desired to absorb the shock.

The Brazilian Battleship "Rio de Janeiro"

By Oscar Parkes

THE Brazilian battleship, "Rio de Janeiro," which was launched at Messrs. Armstrong, Whitworth & Company's Elswick yard on January 22nd, is at present the biggest battleship afloat, displacing as she does nearly 28,000 tons, with dimensions of 660 feet (w. l.) by 93 feet by 28 feet.

As originally designed she was to have displaced 32,000 tons and carried an armament of twelve 14-inch guns, but consequent upon a change of presidency the plans were altered, "considerations of every kind pointing to the inconvenience of acquiring such a vessel." Drastic alterations were, therefore, made in the specifications and the present design substituted.

The main armament of fourteen 12-inch guns is carried in seven twin turrets of 9-inch armor, all disposed along the center-line, four being on the forecastle deck and three on the upper deck. When the first details of the ship became public it was asserted that the fourteen guns would be disposed in two triple and four twin turrets, and it was quite possible that some such idea was at one time considered.

The triple turret originated in Germany, but has never been adopted there, and in Great Britain it has always been regarded with disfavor; on that account it is not likely that Messrs. Armstrong would recommend its being installed in the "Rio" had the Brazilian Naval Commission originally decided to so mount the guns. The present arrangement allows for all the weapons to have bilateral training with a fore and aft fire of four guns. A secondary battery of twenty 6-inch guns are mounted along the upper deck and in the superstructures, and of these six have axial fire, fore and aft.

The upper deck guns have 6-inch protection, while the remainder are behind shields. In addition twelve 3-inch q. f. are distributed over the superstructures and have a good all-round concentration of fire. Three 21-inch tubes constitute the torpedo equipment.

The "Rio's" protection consists of 9-inch water-line, lower and main deck belts. Forward, the main deck belt is 4 inches and the other two 6 inches in thickness, while aft the water-line and lower decks have 4 inches to within some 30 feet of the stern. Forward there is a 12-inch conning tower, and aft a small armored observation tower, at the base of the mainmast.

An interesting feature of the ship is the provision of three-armored decks of 1-inch, 1½-inch and 2-inch from above downward.

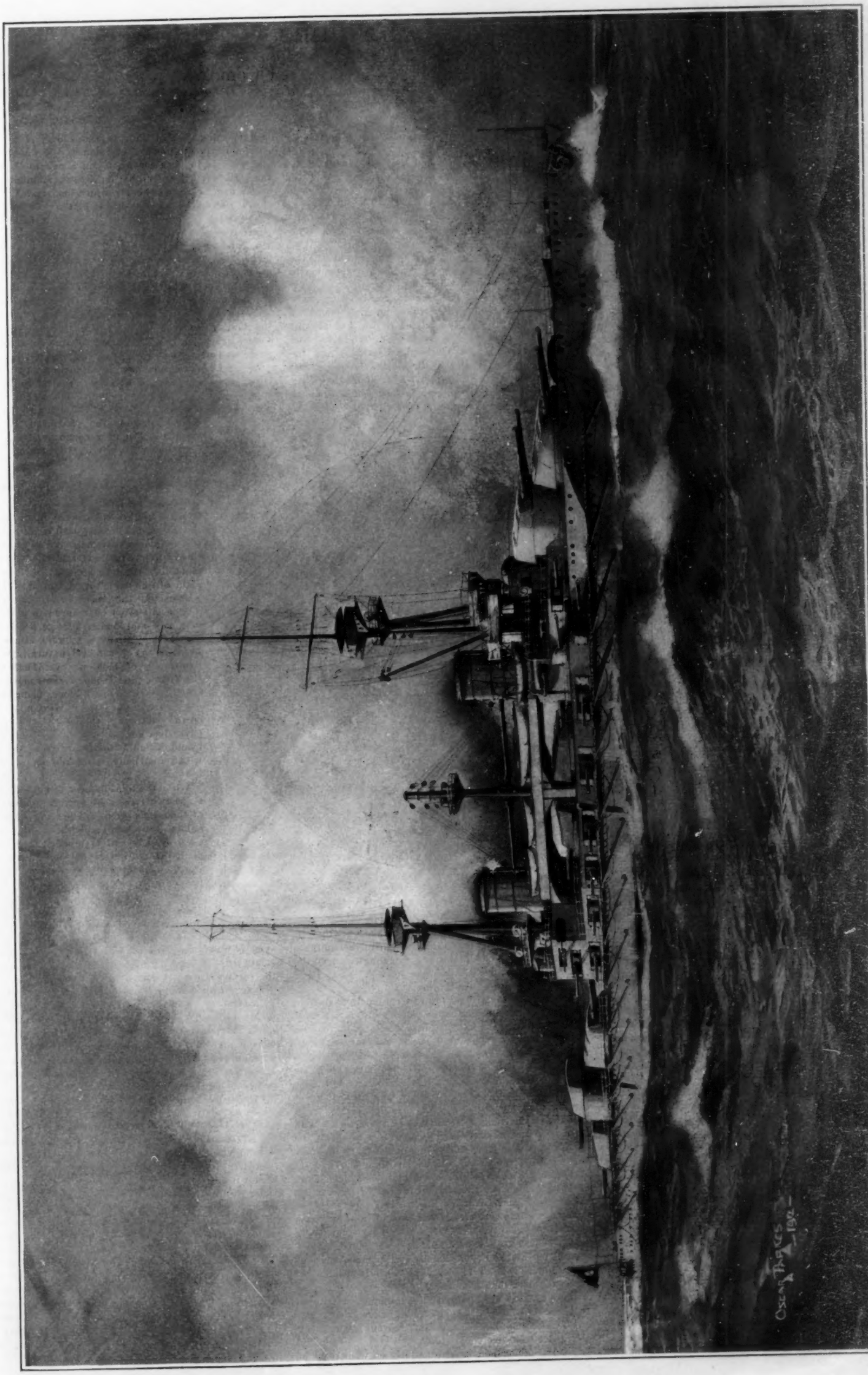
With a designed horse-power of 45,000 generated by Parsons turbines, the speed is expected to exceed 22 knots. The coal supply is 1,500 to 3,000 tons, plus oil fuel—an exceptional amount for South American ships.

The "Rio" was laid down in December, 1911, and is to be completed early next year. In appearance she suggests a huge "Neptune," and will be quite the most formidable-looking ship afloat with her seven big turrets, lofty superstructures and boat deck, huge oblong funnels, tripod masts and arsenal of secondary and tertiary guns.

Cork Paper and Its Uses

ENORMOUS quantities of cork are used annually for making tips on cigarettes. For this purpose the cork is converted into very thin sheets which constitutes what is known as cork paper. These sheets are exceedingly thin and come in the market 4¼ inches in width and 6, 7, 8, 9, and 10 inches in length. A package of about two hundred and fifty sheets is scarcely an inch thick. Practically all the cork paper that comes to this country is entered through the New York Custom House and is valued (including 30 per cent duty) at about $300,000 annually. It is estimated that approximately one half million dollars worth of cork is converted into cork paper every year, and almost all of this is used for making tips on cigarettes.

The thin cork is pasted on long sheets of paper, which are passed between rollers and automatically covered with paste, while girls with deft fingers lay on the cork and smooth it down as the paper passes along. After this the sheets are passed through the cutting machines, in which they are divided into 8 strips ½-inch wide and wound on reels for use in the automatic cigarette tippers. Each of these machines has a capacity of 10,000 sheets of cork paper a day. The total number of sheets used in the world is about 100,000,000, or about a quarter billion square feet. The cigarette tipping machines have a capacity of about 60,000 cigarettes daily. The cost of the finished tips to the cigarette manufacturer is from 9 to 20 cents a thousand.



THE BRAZILIAN BATTLESHIP "RIO DE JANEIRO."

The Heavens in June

Some Data on Schaumasse's Newly-discovered Comet

By Henry Norris Russell, Ph.D.

THE first comet to be discovered in 1913 was found by Schaumasse at Nice, on the morning of May 7th. It was then in the eastern sky, in 20 hours 55 minutes R. A. and 10 degrees north declination, between Pegasus and Delphinus. Its motion northeastward, and pretty rapid, and it was visible in a small telescope.

Numerous observations have been secured, and a preliminary orbit was very promptly computed by Kiess and Nicholson at the University of California. This shows that the comet was discovered just before its perihelion passage, which took place on the 18th. Its orbit is inclined about 26½ degrees to the plane of the ecliptic, and its motion is retrograde, i. e., it is going around the Sun in the opposite direction from the Earth and the other planets. When nearest the Sun it was 133 million miles from him, and it, therefore, never came inside the Earth's orbit.

As it is moving in the opposite direction to the Earth, its apparent motion in the sky will for some time be rapid; and as it is far north of the plane of the ecliptic it is apparently high in the heavens, and so is easy to observe. The ephemeris of its motion which is at present available extends only to May 24th, when its computed position is 19 hours 11 minutes plus 30 degrees. A plot of its orbit shows that on May 17th it was about 76 million miles from the Earth, and approaching it. It will be nearest us about June 3rd, at a distance of some 65 million miles, and then recede with increasing rapidity. From the rough indications regarding its brightness which are available it seems doubtful whether it will become visible to the naked eye, and certain that it will not become at all conspicuous. Exact predictions of its track in the sky during June must await computations based upon a longer interval of observation; but it can be stated that, unless the preliminary orbit should turn out to be seriously in error, the comet will move nearly along a line drawn from β Lyræ to η Ursæ Majoris (or perhaps a little south of this), being near the former star about May 27th, and reaching the vicinity of the latter somewhere about June 20th.

Though these indications are necessarily rough, they may be of aid to amateurs who wish to try to "sweep" for the comet.

It will probably not be until all the observations have been laboriously discussed, long after the comet has vanished into the distance, that we will know whether it is moving in an ellipse of long period, or paying us a single visit in a practically parabolic orbit, though in the rather improbable event that it should prove to have a short period, this fact may be found earlier.

The Heavens.

Turning to our star-map, we may find with its aid many objects of interest, whether the observer has at his disposal a telescope, or merely a field-glass. One of the finest regions in the sky is now full in sight in the south—the great star-clouds in Sagittarius and Scorpio. Even to the naked eye this is a magnificent spectacle, and the brightness of the Milky Way, on a clear night, is surprising. With a field-glass many brighter patches of small area may be seen in the Milky Way, most of which are star clusters, though a few prove when examined with higher power to be irresolvable nebulæ. One cluster, a little above λ Scorpii, is particularly fine, and some of its component stars may be seen with a field-glass. There is no finer region anywhere for telescopic sweeping, whatever the size of one's instrument.

In Scorpio itself we may note the wide double star μ, easily separated by an opera glass, and even by the naked eye, when the air is clear enough to give a good view of an object so far south. With a small telescope the stars β and γ are seen to be beautiful and easy pairs. About half-way between α and β Scorpii is Messier 80, a globular cluster of stars, so faint and so close to one another that in a small instrument it looks like a small nebula.

Passing westward into Libra, we find the star α to be a beautiful pair, revealed by a field-glass.

γ Virginis and ϵ Bootis are all fine and well-known telescopic pairs, the first separable with two inches aperture, while the last demands three inches or more.

Passing to the north we find that α Canum Venaticorum is a fine pair of 20 seconds distance, while the Pole-star itself has a companion of the ninth magnitude, about 18 seconds away.

β Cephei (distance 13.5 seconds) and β Cygni (34.3 seconds) are fine easy pairs, and so is 61 Cygni (22.5 seconds) one of our nearest stellar neighbors.

Finally, in Capricornus, low in the southeast, the star α is a fine naked-eye double, and a companion to β is easily seen with a field-glass.

Many of the most conspicuous constellations now visible have been noticed in this survey. Among the others we find Corvus, the tail of Hydra, and part of Centaurus setting in the southwest. Hercules and Corona Borealis almost overhead. Ursa Major in the northwest. Draco high in the north. Cepheus and Cassiopeia low in the northeast. Lyra high in the east, with Aquila lower down and farther south, and the small but conspicuous group of Delphinus, with the ancient but less prominent figure of Sagitta (the Arrow) on the left of this. Finally, high in the south, is the tangled mass of Ophiuchus, struggling to carry the great Serpent which it is his fate to hold.

At 11 o'clock : June 7.
At 10½ o'clock : June 14
At 10 o'clock : June 22.

At 9 o'clock : July 7.
At 8½ o'clock : July 14
At 8 o'clock : July 22.

At 9½ o'clock : June 30.

NIGHT SKY: JUNE AND JULY.

The Planets.

Mercury passes through inferior conjunction (behind the Sun) on the 1st, and is an evening star for the rest of the month. He can be best seen in its closing days, when he sets about 9 P. M., and can easily be seen in the twilight a little south of the region where the Sun has set. He is apparently about as bright as Procyon, and brighter than either Castor or Pollux, near which two stars he passes about the 23rd.

Venus is morning star, in Aries, rising about 2:15 A. M. She is still exceedingly bright, and can easily be seen in full daylight. The only difficulty is to know where to look for her. On the morning of June 1st she is about 4 degrees south of the Moon, and should be easily found with a field-glass, and even with the naked eye, if the weather is really clear.

Mars is also a morning star, and is not far from Venus, about 13 degrees farther west and higher in the morning sky. He is a far less conspicuous object, sending us less than one hundredth as much light as Venus; but, even so, he looks like a pretty bright star of about the second magnitude.

Jupiter is in Sagittarius, approaching opposition, but rises late (about 9 P. M.) on account of his great southern declination, and, for the same reason, is not favorably placed for telescopic study.

Saturn, having just passed conjunction with the Sun, is a morning star in Taurus, visible only just before sunrise toward the end of the month.

Uranus is in Capricornus, rising about 10 P. M. on the 15th, but not observable until after midnight.

Neptune is approaching conjunction, and is practically invisible in the evening twilight.

The Moon is new at 3 P. M. on the 4th, in her first quarter at noon on the 11th, full at 1 P. M. on the 18th, and in her last quarter at the same hour on the 26th. She is nearest us on the 10th, and farthest away on the 25th.

As she completes the circuit of her orbit she passes through conjunction with Venus on the 1st, Saturn and Mercury on the 4th, Neptune on the 7th, Jupiter on the 19th, Uranus on the 21st, Mars on the 29th, and Venus again on the 30th, none of the apparent approaches being close.

Mercury and Neptune are in conjunction on the 24th, but they are too near the Sun for the latter to be seen.

At 8 A. M. on the 21st the Sun reaches his greatest northern declination—23 degrees 27 minutes 10 seconds—and, in the language of the almanacs, "summer commences."

Princeton University Observatory.

The Rarest Trees in the Country

IT is an interesting feature of the flora of the coast of Southern California and the adjacent islands that they contain several plants extremely localized. If the theory of gradual extermination of some plant forms can be accepted, at least one plant can be named here, which will show conclusively that once widely distributed plants will often be reduced to a few individuals and finally become wholly extinct. The Monterey cypress (*Cupressus macrocarpa*) is confined naturally within the county of Monterey, California, and the Torrey pine (*Pinus torreyana*) has its limits restricted still more, being found only in a narrow belt a few miles long on the coast near the south of the Soledad River just north of San Diego, and on the island of Santa Rosa, California; the least widely distributed pine tree in the United States.

While the total number of individuals of these two trees still aggregates hundreds of thousands, there is one plant which inhabits the small Southern California coast islands and is probably the rarest plant in America. It is the western ironwood (*Lyonothamnus floribundus*) and is the only tree species of the saxifrage family of plants. It was not found and described until 1884 by William S. Lyon, Forester of the State of California. On these islands is the last stronghold in America of this very peculiar type, which, as it still exists only in small patches, once occupied a much larger space on the continent than it does at present.

The *Philippine Agricultural Review* of February, 1913, reports two other very rare trees in the Formosan forests. One of these is the shimamomi (*Ketelecria davidiana*), of which there is only one small cluster known to exist on the island. A still more striking case is that of the *Cunninghamia konishi* of Mount Randai. The number of individuals of this tree has been reduced to only five living species.

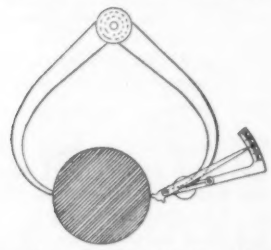
The World's Production of Tea

ALTHOUGH it is difficult to give a close figure for the world's production of tea, this is said to be over 1,127,700 (long) tons. That this is not exaggerated will be seen from the following data for production: India, 123,200 tons; Ceylon, 85,000; Java, 22,900; Japan, 19,400; Formosa, 11,600; China (exportation), 53,600; Natal and Annam, 1,400 tons. To this is to be added at least 36,000 tons of compressed tea in tablets, which is put directly on the market by Chinese firms. There must also be taken into account the tea produced in China and Japan and consumed on the spot, this being estimated to be 5 pounds or less per head, so that for 342,000,000 inhabitants this figures at 774,600 tons. For this reason China and Japan do not figure higher in the export list. It is estimated that the total consumption of tea for the rest of the world is 300,000 tons.

How to Measure Closely With Ordinary Calipers

By H. D. Chapman

THE sketch shows how to get an exact measurement with ordinary calipers. The writer had to machine up a piston for a hydraulic press, and it was to be made the exact size of the old one. No micrometer was to be had large enough to take that size; so in order to be sure that the size was the same, a test



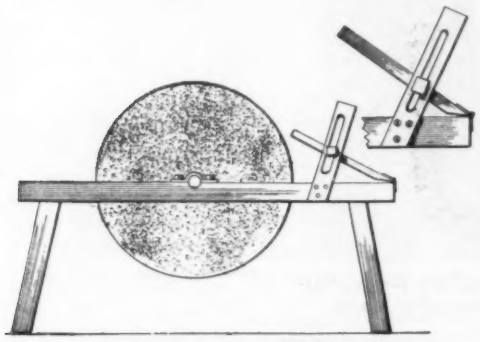
Measuring closely with the calipers.

indicator was attached to one leg of a pair of outside calipers, as shown in the engraving. The calipers were then set to the size of the old piston, and by so doing the pointer on the indicator was set so it would point at any certain figure. The sketch shows the reading at 20. By the use of the calipers fixed in this way it was possible to make an exact duplicate of the old piston. Of course it is understood that calipers rigged up in this way can only be used in transferring sizes or to be used as a test.

A Toolholder for Grindstones

By William Grötzinger

WHEN grinding tools by simply holding them with the hands against the stone, frequent changes of angle will cause much extra labor and result in a poor job. A simple device to hold tools at a constant angle while grinding can easily be made and attached to the grinding stone as follows: Screw on each side of the base of the grinding stone, a wooden arm as pic-



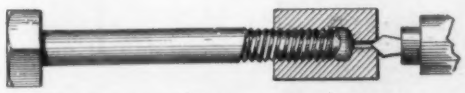
Toolholder for grindstones.

tured in the drawing. These arms should be slotted. A board a little larger than the ordinary plane iron is cut and bored with a ¼ inch hole, running from edge to edge. The board is fastened to the grindstone with a hinge. A bolt is put through the slots in the arms and the hole in the board. The bolt may be tightened up to hold the board at any desired adjustment. The tool to be sharpened is placed on the board and held firmly. This arrangement will allow tools to be set at any cutting angle.

Jig for Turning Up Rough-threaded Bolts

By Joe V. Romig

NEEDING a hundred finished bolts of ⅞ inch diameter and having nothing on hand except rough ones already threaded, the writer was forced to rig up a jig of his own design with which he could turn up the body of the bolt concentric with the thread and the underface of the head at right angles to the finished body. How the work was done is shown in the accompanying illustration. A nut was made from a piece



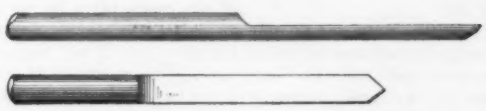
Jig for turning up rough-threaded bolts.

of octagonal steel 1⅞ inches thick and 2¼ inches long. This was chucked up and drilled and then tapped to receive the threaded end of a bolt. A 3/16 inch hole was then drilled through the end of the nut. The nut was now taken out of the lathe, rechucked and countersunk at the outer end of the 3/16 inch hole to receive the tail stock center. This completed the jig. The bolt was then screwed into the jig and placed in the lathe, as indicated in the drawing, with the head of the bolt held in the chuck, after which the body and head of the bolt were finished.

Hint for Boring a Straight Hole

By Joseph Vaghi

TO bore a straight hole 3/16 of an inch in diameter, lengthwise through a 12-inch maple round, ¾ of an inch in diameter, is far from a simple task, so the writer was informed by a company manufacturing bits. But as a large number of rounds had to be bored in this manner, the writer was compelled to invent a practical method of doing the work. After a number of schemes had been tried, a successful solution to the problem was reached. A piece of tool steel 3/16 of an inch in diameter was tempered at one end and



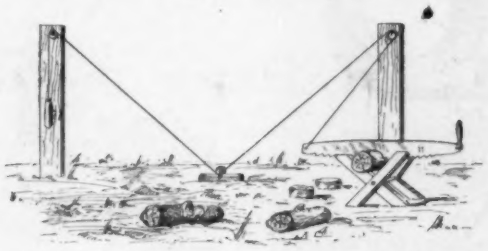
Bit for boring a straight hole.

ground off to about one half its thickness, for about two inches from one end, as shown in the drawing. The tool was ground to a chisel point as shown in the drawing, and in order to make it run more easily, a little was filed off back of the cut. Running this through a steel bush at the rate of 1,500 revolutions per minute, the rounds were quickly bored at the rate of seventy per hour. Twenty-five hundred rounds were bored without a single miss, whereas in previous attempts with the best single groove bit on the market 80 per cent of the rounds were wasted.

Rig for a Two-handed Saw

By Fremont Leland

THE accompanying drawing shows how a two-man saw may be rigged up to be operated by one person. The writer designed this arrangement for the purpose of sawing a large number of logs single handed, and he found the device very successful. The saw-horse was placed beside a post on which a pulley was mount-



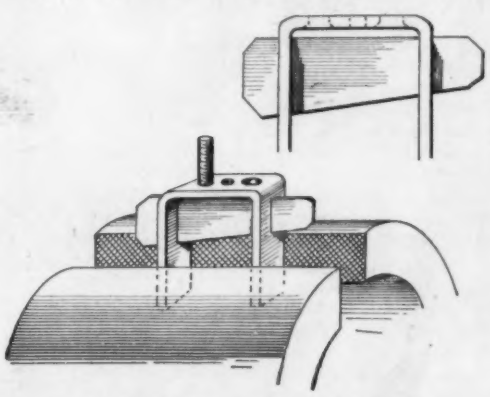
Rig for operating a two-man saw single-handed.

ed. Another pulley was secured on a second post, while between the two a pulley block was fastened to the ground. A rope tied to the free end of the saw passed over the pulleys on the posts and under the pulley block between them. The opposite end of the rope carried a small weight. With this arrangement the sawing of the logs was greatly facilitated.

Device for Holding Screws When Filing Them Shorter

By I. B. Spittell

A VERY simple device for holding screws while filing them down is shown in the accompanying illustration. It consists of a piece of flat iron about an eighth of an inch thick and say ¾ of an inch by 3½ inches long. The piece is bent to a U form. In the bottom



Device for holding short screws in a vise.

of the U-piece holes are drilled to receive screws of different sizes. In the sides of the U-shaped piece, slots are cut to receive a wedge or key of steel. In use the screw is fitted into one of the holes in the U-shaped piece with the head inside, and is held firmly in position by driving the key in place. Then the device may readily be secured in a vise while the projecting end of the screw is filed down to the required dimensions.

Two Drilling Kinks

By Fred Horner

HERE are two kinks that have proved very serviceable to the writer and he hopes will prove equally serviceable to the reader.

Using a Rubber Band as a Drill Stop.—A simple form of stop for small drills which are used in the hand-brace, or in a drilling machine which has no depth stop, is a rubber band. This is slipped over the drill to the required distance, as shown in Fig. 1, and each time that it reaches the face of the work the drilling is stopped. This dodge works well enough for occasional use, and the band is more easy to work with than a chalk mark on the drill.

Fig. 1.—Drill stop

Rubber-faced Drilling Pad for the Tail Stock.—Fig. 2 shows a handy form of drilling pad to be fitted to the tail stock of a bench lathe. It is of particular use when drilling small brass plates and other highly polished pieces which are liable to slip on the surface of a metal pad and become scratched. A disk of rubber is connected to the face, and this makes a soft bedding for the work, preventing it from skidding or

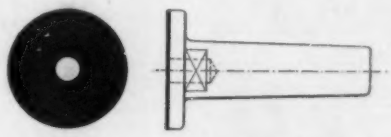


Fig. 2.—A rubber-faced drilling pad.

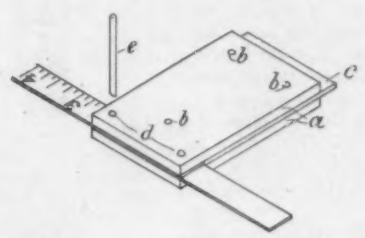
slipping. The rubber disk will be found better in this respect than wood. As an alternative a small block of wood may be faced with rubber and held with the fingers against any part of the drilling pad.

Mending a Broken Steel Tape

By George W. Colles

EVERYBODY who owns a steel tape will sooner or later want it mended. The two pieces should be joined by a butt-strap, which is riveted to both pieces by means of small eyelets made for the purpose. Instrument makers furnish special tools costing $5 for punching and setting the eyelets, but few will care to invest $5 to mend a $1 tape. A half-hour's work at the bench and a few scraps of sheet metal will make a tool which is as satisfactory for practical purposes as a purchased one.

Take two pieces of strap-iron (*a* in the accompanying sketch) about 2 inches long and ⅛ inch thick, exact dimensions immaterial, ½ to ¾ of an inch wide, depending on the length of the desired overlap. Take a thin strip of sheet metal *c* of the same size and having the combined thickness of the tape and strap, or preferably a little less; place all together in the vise,



Mending a broken steel tape.

and with a No. 50 drill bore three holes *b*. Removing the pieces from the vise, lay the tape across one end of the strip *c* and scribe along the edge so as to mark a strip having the same width as the tape, which strip is to be cut off. Now replace the three pieces in the original order, cut three short pieces of No. 50 or 49 Stubs' steel rod, and hammer them into the holes *b* for dowels. Two other holes *d* are now drilled along the center line of the cut-off strip of the piece *c*. Cut a short piece *e* off the drill-rod and file it obliquely on one end for a punch, and the apparatus is complete. All you have to do is to insert the tape and butt-strap, as shown, and punch through the holes *d* with a punch *e*. It is necessary to have the rod *e* slightly larger than the drill, so that it will fit snugly in the holes. When the holes are drilled, the eyelets are inserted and turned over with a center-punch and hammer. If the strip *c* is sufficiently thin, the tape and strap may be gripped in a vise during the operation, but I have not found this necessary.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Activity in the Explosive Pump Art

AN extremely important patent, of interest to inventors and the scientific world in general, was granted not so long ago to W. H. Smyth of Berkeley, Cal. This patent, the application for which had been pending in the Patent Office since 1900, and which is a pioneer in the art, discloses an internal combustion pump for raising water.

The Smyth pump, as seen in the accompanying engravings, is a duplex one, both parts being alike. A combustion chamber 1, the lower end of which is merged into a nozzle 3, extends into a casing 4, which constitutes the suction pipe of the pump. The lower end of this casing is provided with a check valve 5 and a strainer 6, and the upper end is separated from an air chamber 8 by the check valve 7. As seen in Figs. 1 and 2, the discharge of the pump is through a pipe 20, which connects with each air chamber 8. Two pipes 9, having valves 10 to control the flow of air or water, connect the air chamber 8 with the casings 4 just below the valves 7. A water piston, operated by the explosive charge, is located in each chamber 1, and the two casings 4. Air is introduced into the air chambers by means of valves 5a.

To regulate the position of the water piston in the chamber 1, an independent piston 11, free to move in response to heat pressure, is provided in the pipe connecting the two casings 4. This piston is actuated by the power piston 19 in the motor cylinder 15, through the link 18, lever 17 and rock shaft 12 and link 16 connected by the yoke 42 to the rod 13, which passes through a stuffing box 14.

As seen in Fig. 3, the motive fluid for operating the motor 15 is introduced and exhausted to and from the cylinder by a four-way valve 43 through pipes 45, 44 and 46. This valve is operated by the link 16, carrying the tappet 53, which actuates the levers by riding over the cam surfaces 52. These levers 51 operate in turn, by means of the spring-operated tappets 50, the sliding tappet lever 48, which oscillates the lever 47 of the valve 43.

The apparatus for introducing an explosive mixture is shown in detail in Figs. 4 and 5.

A fuel reservoir 27 (see Fig. 1) is connected to a vaporizer 26, which communicates with the combustion chambers 1 by a pipe controlled by the poppet-valve 24 and pipes 23 leading to a four-way valve 22. The sparking device, located in the chamber 29, consists of a rocking wiper 30 secured on the shaft 31, which is provided with an operating lever 32, and a flat spring 33 attached to an insulated rod 34. The wires 40 and 41 connect the sparking device with a battery not shown. The tappet arm 28 on the shaft 12 operates both the valves 10 and the wiper 30 by means of the slotted link 36 carrying the pins 37 and 38.

The valve 22, which controls the flow of gases to or from the combustion chambers, is also operated from the rock shaft 12 by the tappet 21, the latter having a cam surface 21^a, which operates one arm of a loosely pivoted bell crank tappet lever 22^c. This arm of the tappet lever 22^c engages with the slotted link 22^b, which is loosely connected to the handle 22^a on the stem of the valve 22. The other arm of the lever 22^c constitutes a tappet which, by engaging the part 21^b of the tappet 21, operates the spring-actuated valve stem 25 of the check valve 24, so that the tappet 21 serves the double function of reversing the valve 22 and keeping the valve 24 open. The operation is now evident.

Motion is imparted to the piston 11 by the motor 15, which causes the water piston to move in the chamber 1 and make room for the charge in this chamber. The valve 22 being properly disposed, the action of the piston 11 and the travel of the water piston cause successive inflow of explosive charges and scavenging of the spent gases.

If we assume the explosive charge to be in chamber 1, the water piston will extend nearly to the valve 7, separated from the water and pressure in the air chamber 8 by this valve and by whatever air has been permitted access through the valve 5^a. At this point the valve 10 is opened by engagement of the tappet arm 28 with the link 36 and the compressed air, or water under presure from the air chamber, consequently flows beneath the valve 7. Thus the water piston is forced back against the charge, compressing it to the pressure of the air chamber, which is, of course, that of the head. The charge is prevented from escaping by the closing of valve 24.

Ignition now takes place resulting from the engagement of the tappet pin 37 with the end of the slot in the link 36, thus rocking the wiper 30 past the spring 33 by the connection of the link 36 to the wiper arm 32. The slot in the link 36 permits the valve 10 to close the moment the wiper arm 32 passes out of engagement with the spring 33. The expansion of the gases in the chamber 1 causes the water piston to be driven with great energy and speed through nozzle 3.

The spaces vacated in the chamber 1 and casing 4 are filled instantly (practically simultaneously with the expansion) by air through valve 5^a. That portion of the air admixed with the spent gases in the casing 4 of the expansion chamber will be cut off and separated from that in the charged chamber 1 by the incoming water through valve 5. The portion of air and gas in the casing 4 is thus trapped beneath valve 7, ready to be driven into the air chamber at the next operation of the water piston. That portion of the spent gases and air in the chamber 1 will pass out as exhaust. The cycle of operation of the Smyth pump is shown in Fig. 6, and described as follows:

1.—Explosive charge being taken in the left hand chamber and discharging the spent gases from the other chamber, the piston 11 being midway of its stroke, traveling to the right.

2.—A fresh charge in the left hand chamber and the right hand chamber completely occupied by the water piston, the spent gases of the previous explosion having been driven out by the water.

3.—Charge in the left

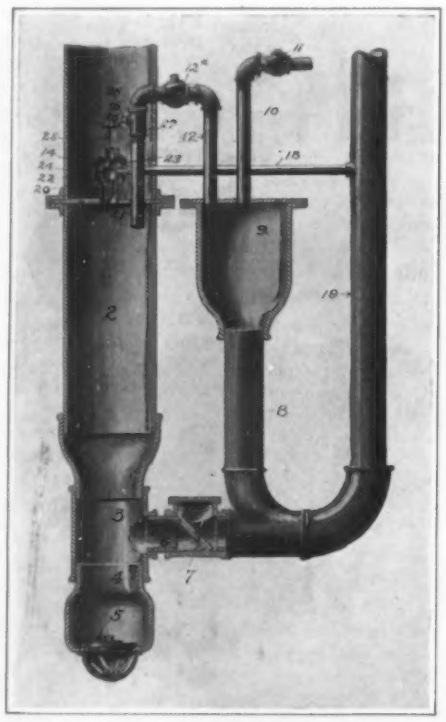


Fig. 8.—The White pump for utilizing full static pressure in compressing the charge.

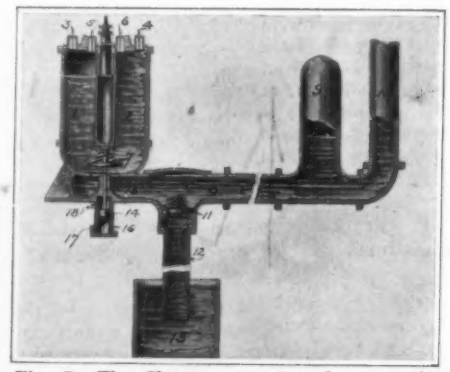


Fig. 7.—The Chance apparatus for operating internal combustion pumps and compressors.

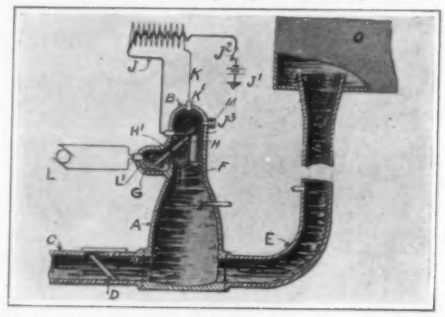
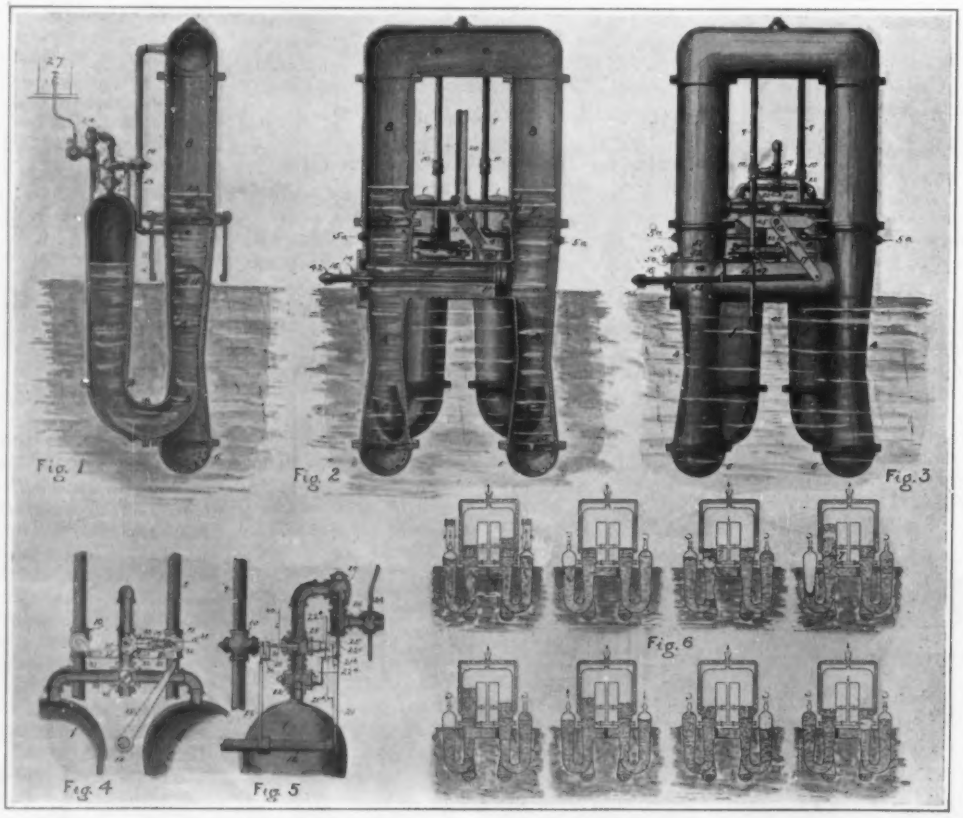


Fig. 9.—Poore and Harvey device for generating its own gas by electrolysis of water.



Figs. 1 to 5.—Detail of the Smyth internal combustion pump for raising water.
Fig. 6.—The cycle of operation of the pump.

hand chamber compressed to less than half of its original bulk by the admission of air pressure between the water piston and the check valve 7.

4.—Expansion of charge due to explosion and the travel of the water into the air chamber, preceded by the volume of air from beneath the valve 7. The inrush of the water through the lower check valve 5 induced by the injector, gravity and atmospheric pressure is also shown.

5.—Left hand chamber almost filled with water.

6.—Condition similar to I, but reversed as to direction of the flow of gases and the movement of the water piston.

7.—Charge in the right hand chamber. The left hand chamber is completely scavenged of spent gases from previous explosion.

8.—Explosive charge in the right hand chamber ready to be ignited, thus completing the cycle.

It has been the custom in explosive pumps having two combustion chambers to cause the charge to be drawn into one chamber by the continued travel of the liquid piston after the waste gases in the other chamber have dropped to low pressure. In pumps of this character the continued travel of the liquid piston must be sufficient to draw in the new charge; the expulsion of the waste gases is accomplished by the return stroke of the piston and must be completed before the return stroke can compress the charge in the other chamber.

The necessity for prolonging both the out stroke and the return stroke of the piston to permit the drawing in of the charge and the expulsion of the waste gases, introduces elements of time by which the capacity and speed of operation of the pump are correspondingly reduced.

A recent patent granted to Messrs. H. M. Chance and T. M. Chance of Philadelphia, Pa., shows a method of operating such pumps whereby the rapidity of action is increased by decreasing the time necessary for each out stroke and return stroke.

The apparatus, as seen in Fig. 7, comprises two combustion chambers 1 and 2 provided with inlet valves 3 and 4 for the introduction of the combustible mixture and two exhaust valves 5 and 6 for the discharge of the waste gases.

A spring-pressed valve 7, which controls the communication between the two chambers 1 and 2, is operated by the rod 15 and piston 14 in the cylinder 16. This cylinder communicates with the liquid in the chambers 1 and 2 by the passage 17, and the connection 18 leads to a source of pressure slightly greater than that at which it is desired to exhaust the waste products of combustion. The usual conduit 8 is connected to the air chamber 9, delivery pipe 10 and suction pipe 12 with inlet valve 11. This suction pipe 12 is connected with the source of supply 13.

Let it be assumed that the chamber 1 contains a compressed combustible charge which has just been ignited, the valve 7 being open, the liquid in the conduit 8 is given a high velocity.

When the pressure in the chamber 1 falls below the predetermined pressure at which it is desired to open the exhaust, the valve 5 is opened and the valve 7 closed by the piston 14, operated by a pressure slightly greater than that now existing in the chamber 1, the scavenging taking place at atmospheric pressure. The liquid in the chamber 2 now falls by gravity; the inlet valve 4 opens; and a new combustible mixture enters the chamber 2. At the same time the liquid rises in the chamber 1, expelling the waste gases. The valve 4 then closes.

Upon commencing its return stroke the liquid in the conduit 8 opens the valve 7, forcing the liquid into the chamber 1 and closing the valve 5 by the impact of the liquid. The momentum of the liquid in the conduit 8 now causes the liquid to rise in the chamber 2, compressing the charge in that chamber. The cycle is then repeated.

It will thus be seen that a new charge of combustible mixture is introduced while the products of combustion are being discharged, obviating the necessity for prolonging both out stroke and return stroke, and in this manner increasing both the speed and the capacity of the pump.

In explosive pumps it has been the custom to compress the combustible charge in the same chamber in which it is exploded. A recent patent granted to C. E. White of San Francisco, Cal., shows a pump in which the charge is first drawn into a separate chamber and forced thence into the usual combustion chamber by the pressure of the liquid in the delivery pipe. By this means, it is claimed, the full static pressure is utilized in compressing the charge.

The White pump, as seen in Fig. 8, comprises a combustion chamber 2 connected to the supply pipe 4 having the usual inlet valve 5, by the tee 3, which communicates with the delivery pipe 19 through the pipe 6, in which is placed a check valve 7. This delivery pipe 19 is connected to the gas chamber 9 by a pipe 8.

The gas supply pipe 10, having the check valve 11, communicates with the chamber 9, the latter being connected with the chamber 2 by the pipe 12 having a check valve 12^a.

The exhaust valve 14 comprises a cup 20 provided with a bored extension 21 and a diaphragm 22. This diaphragm 22 is provided with a valve 23 adapted to enter a seat 24, the stem 25 of the valve 23 is provided with a contact 26 to bridge the terminals 27 and 28 to close the circuit of the spark plug 16. A pipe 18 connects the delivery pipe 19 with the cup 20.

Let it be assumed that the pump is filled with liquid and an explosive mixture, the contact 26 closes the ignition circuit through the terminals 27 and 28 and the charge is exploded. The liquid is thus forced through the pipe 6, closing the valve 5 and opening the valve 7. The liquid in the chamber 9 and pipe 8 moves downwardly, creating a suction in the chamber 9, whereupon the valve 11 opens and causes a fresh supply of gas to be drawn into the chamber 9. As the liquid moves upwardly in the pipe 19, the pressure on the diaphragm 22 is removed, and the contact 26 is moved downwardly, permitting the escape of the waste gases.

After the explosive force is spent, the liquid in the pipe 19 closes the valve 7 and the liquid piston in the pipe 8 and the chamber 9 forces the explosive mixture into the chamber 2 and compresses the charge against the water, which has by this time risen in the chamber 2.

The cycle is then repeated.

In internal combustion pumps it has been necessary after each explosion to draw in a fresh charge of gaseous mixture from an outside source. This has necessitated gas and air connections which are impracticable when such pumps are used in mines and in many other instances.

To obviate this difficulty, Messrs. Poore and Harvey of London, Eng., have recently patented a device which generates its own gas by the electrolysis of water. No pipe connections whatever except those used for suction and delivery of the water are thus needed.

In Fig. 9, the current for decomposing the water is supplied by the dynamo L to the contact L^1, which makes a sliding contact with the chamber G at prearranged periods of time. The upper part B of the body A of the pump forms the explosion chamber. The gases formed by the electrolysis of the water are mingled with air introduced in the chamber B through the air valve M, and are exploded by the spark plug K^1.

The ignition circuit comprises a primary winding J, having a battery J^1 and switch J^2, and a secondary winding K. The float F, carried by the lever H, which is pivoted at H^1, operates to close the firing circuit.

The apparatus is operated by closing the switch J^2 and turning on the decomposing current. The float F is then in its lowermost position, and the contacts L^1 are in contact with the chamber G.

As the water rises, the float F moves the chamber G out of contact with the contact L^1 and, rising still farther, causes the lever H to contact with the contact J^3, thereby closing the primary circuit. The charge is then fired by the plug K^1.

The force of the explosion expels the water up the delivery pipe E into the tank O, and also draws a fresh supply of water through the suction pipe C. The return movement of the water closes the check valve D and compresses the new charge of explosive mixture. The cycle is then repeated.

The pipe N is used to form a spray for condensing the vapor caused by the explosion.

Legal Notes

Employer and Employee.—The Court of Appeals of the District of Columbia in Eshleman v. Shantz and Shantz v. Eshleman has held that even if E was in the employ of S, such fact did not deprive E of his right to claim the invention as his own where it appeared that S's communication to E went no further than to evince a desire for a certain result, S suggesting no means by which the result could be accomplished.

Interference Examiners.—The Interference Division of the Patent Office was instituted in 1869, prior to which time interference proceedings were tried and decided in the first instance by the principal examiner in charge of the division in which the interference originated. In the 44 years of the existence of the division, there have been 15 examiners of interferences, beginning with the first incumbent, J. M. Thatcher, appointed July 17th, 1869, to the present examiner, H. E. Stauffer, appointed May 6th, 1910. The longest term of service as examiner of interferences was that of Judge Walter Johnson, now a principal examiner in the Patent Office, whose service extended from November 9th, 1886, to July, 1902, a period of nearly 16 years and more than four times as long as the term of any other official who has occupied the position. The rest of interference examiners with the years of appointment is as follows: J. M. Thatcher, 1869; J. H. Adams, 1870; M. S. Hopkins, 1872; W. B. Phillip, 1874; J. Newland, 1875; H. H. Bates, 1876; Z. F. Wilbur, 1877; J. B. Church, 1880; F. McArthur, 1883; W. Johnson, 1886; C. F. Fitts, 1902; C. C. Billings, 1905; J. B. Macauley, 1907; F. Bayard, 1907; H. E. Stauffer, 1910.

Property Rights Overhead.—The Supreme Court of the United States has before it on appeal from the Court of Claims the case of Mary R. Peabody *et al.* v. the United States, in which may be determined a question of interest in aviation, although aviation is not specifically involved. It appears that the claimants own a property whose principal value is asserted to result from its use as a seashore resort. Within a short distance of the claimant's land, the United States Government erected a coast defense battery known as Battery Bohlen, and the guns of this battery were so placed that the most suitable field of fire in time of peace was over the claimant's land, and it is claimed several guns were fired on three occasions prior to the institution of the litigation, the shot each time passing directly over the claimant's land. On behalf of the claimants, it is urged that the space above their land was subjected to use by the Government for the firing of projectiles across it, making it impossible to operate the hotel or use the land as a seashore resort, or indeed for any other purpose.

The decision in this case may or may not determine some question of aerial law of interest in aviation, but it is believed that it will be the first adjudication by the court in a course of litigation that must sooner or later be entered upon to determine the relative rights of birdmen and landowners.

Berlin and Paris have police regulations forbidding the operation of flying machines above the city, but it is not known that such municipal regulation exists in this country, although aviators have instituted regulations controlling the height of flight above cities in the interest of safety both of self and to those on the ground.

Notes for Inventors

A Yielding Metallic Railway Tie.—Locksley W. Abbott of Delaware, O., in a patent, No. 1,054,660, shows a metallic railway tie in which there is a main plate upon which are mounted yielding metallic chairs whose tops are spaced above the bottom plate so that the chairs form bows or yielding loops to receive the rails.

Advertising Theatrical Curtain.—Patent No. 1,045,637 to John C. Taylor of Baltimore, Md., presents a theatrical drop curtain on which is mounted a movable advertising sign actuated by a motor, and the raising and lowering of the curtain operates through suitable means to stop and start the motor so that the advertisement will only be caused to operate when the curtain is lowered.

Cream from Butter Fat.—Joseph Willimann of Derby, Conn., assignor to Dairy Machinery and Construction Company of the same place, has patented, No. 1,058,508, a process in which moisture is removed from butter and the concentrated stable butter so formed is kept until required for use, when it is treated with milk and the resulting mixture is homogenized to form cream.

A Novel Flower Vase.—It is desirable to provide for holding flowers so they can be secured at different heights, and Paul Mucke of Schonau, Germany, has secured patent No. 1,045,589 for a flower vase in which there are mounted upon a base plate a number of tubes open at their upper ends and corrugated from the bottom to the top so that the flower stalks may be inserted into the tubes and will be held at any suitable height by the corrugations.

A Fountain Mop for Sinks.—Isabel L. Lewis of Syracuse, N. Y., has obtained a patent, No. 1,054,696, for a fountain mop in which a suitable hose delivers the water to the mop head, which head has a suitable handle, and the hose is branched to couple with both the hot and cold water spigots of a sink so water of any desired temperature may be supplied to the mop.

A Stand-on-end Shaving Brush.—A novel form of shaving brush, having a hollow handle and a reservoir chamber at the end thereof opposite the brush head, is shown in patent to Frederick James Munro, of Halifax, Canada, the reservoir chamber being elongated in the direction of length of the brush and so shaped that when filled with water it will operate automatically to maintain the brush in an upright position.

Makes a Magazine Smoking Pipe.—Patent No. 1,053,039 to Allen A. Karnes of Holliday, Mo., presents a pipe in which there is a magazine chamber adjacent to and in position to discharge to the pipe and a number of conveyors from the bottom of the magazine chamber and may be operated to discharge successively charges of tobacco into the pipe bowl.

An Armor Plate of Nickel.—The claim of patent No. 1,052,718 reads, "An armor plate for treasuries, safes and the like, made of nickel." The patent is issued to Friedrich Paul Georgi of Niederpfannenstiel, near Aue, Germany. The inventor seeks to render futile, attempts to pierce the armor by means of autogenic hole burners, it being asserted that it is more difficult to burn nickel than to burn iron; also that the nickel by combustion is turned into protoneid of nickel, which is much less fusible than nickel.

An Old Cow-milking Machine.—An early cow-milker that had a suspicious appearance because of the well-known cooperation of a water pump with the national milk supply, was patented in 1879 by a Newark, N. J., woman, who connected the barrel of an ordinary suction pump by a pipe with a sack or case of elastic rubber having at its top a contracting band to grip the udder, the sack terminating at its bottom in four tubes to receive the teats and conduct the milk to the connecting pipe and the pump barrel, whence it passed and discharged from the spout of the pump when the pump handle was operated in the usual way.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SAFETY POCKET.—J. W. PENNEWILL, Silver City, New Mex. In this patent the object of the inventor is to provide an improved pocket especially adapted for trousers, and having means whereby to prevent the contents of the pocket from slipping out when the wearer is in a sitting or reclining position.

Electrical Devices.

ELECTRIC SIGNAL BOX.—J. DERBY, 430 54th St., Brooklyn, N. Y. Mr. Derby's invention relates to electric switch boxes, his more particular idea being to produce a switch box having parts actuated electrically and also having connections whereby the box and its various electrically-operated parts can be connected up as a portion of a block signal system.

PRIMARY BATTERY.—H. E. R. LITTLE, 192 Bradhurst Ave., Bronx, N. Y., N. Y. An object here is to provide a structure in which a maximum voltage may be secured at any time without injury to the cell. Also to provide a cell in which the active agent is a gas adapted to be continuously supplied during the use of the cell.

Of Interest to Farmers.

YOKE.—J. LLOBET and J. GIMENEZ, Calle Colon No. 2, Habana, Cuba. The purpose of this invention is to provide a yoke for draft animals such as oxen and the like, to enable the animal to more easily carry a load attached to the yoke. For this purpose use is made of

YOKE FOR DRAFT HORSES.

a main stem adapted to turnably engage the shaft or tongue of a vehicle, the main bearing body mounted to swing on the main stem, auxiliary bearings on the main bearing body, and head bows mounted to swing on the auxiliary bearings.

INCUBATOR.—G. H. LEE, 1115 Harney St., Omaha, Neb. This inventor provides for wholly or partially excluding and admitting heated air to certain and various sections of the incubating chamber; and provides manually operable means for adjusting the distributions to equalize or vary at will the temperature throughout the incubating chamber.

Of General Interest.

FIRE ESCAPE APPARATUS.—T. BOLDIZZONI, 320 E. 49th St., Brooklyn, N. Y. The invention relates to fire escapes of the type which includes a car mounted to slide up and down guides fixed on the surface of the wall of a building, so that the inmates in case of fire, can utilize the same to make their escape by a quick descent to the ground.

WASHER STRINGER.—D. T. VANCE, Plumtree, N. C. This invention relates to devices for stringing washers made of mica or similar material. An object is to provide a device which will string the washer without any attention on the part of an operator. It provides means for separating the waste and broken portions of the washers from the strung washers.

DOWEL.—C. E. EVANS, Weed, Cal. There is always difficulty in securing members together by dowels, so that they will remain secure under varying conditions. With this invention this difficulty is overcome, for the wedge or end member formed at the end of the dowel serves to spread the dowel, and force it into the member at the sides of the hole.

FILE CASE.—J. W. PENNEWILL, Silver City, New Mex. This case has adjustable means for positioning, holding and indexing the contents thereof, whereby the contents of the case while at all times freely accessible and removable, will when in the case be held compactly and in proper position therein.

HARNESS SADDLE.—L. F. C. HAVERLAND and J. H. THOMAS, respectively of O'Connell and Archer streets, North Adelaide, South Australia, Australia. This invention relates in particular to the attachment of the pad to the flap of the saddle. The pad is detachably attached to the flap of the saddle by means of fasteners which can be released and resecured as often as may be necessary for any purpose, as for instance to enable repairs to be effected.

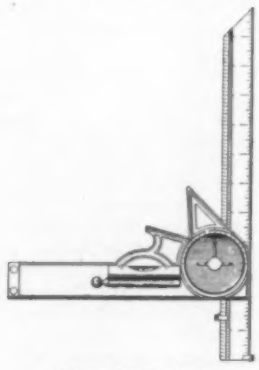
STOPPING AND POURING DEVICE FOR BOTTLES INCLOSING GASEOUS BEVERAGES.—M. LANGLOIS, Domaine de la Cressonnière at Point-l'Evêque, Calvados, France. By means of this invention, the insertion of the pouring tube can be readily done; there is no risk of the tube being obstructed by cork; it can be given a greater diameter than heretofore without inconvenience; moreover, the device can be quickly withdrawn from the bottle before the latter becomes empty, and put on another bottle without loss of time, which, in a café or other drinking saloon, allows of greatly reducing the number of the pouring devices used.

CRATE FOR METAL CYLINDERS.—L. WERLIIN, 2815 Grays Ferry Road, Philadelphia, Pa. By means of this invention a crate is provided having a maximum of strength with a greatly reduced weight. It has a form which permits of long continued use, and constitutes, if desired, a permanent attachment to the cylinder, since the latter may be charged and emptied without the removal of the crate.

NON-REFILLABLE BOTTLE.—J. S. BROMHEAD, 396 Dean St., Brooklyn, N. Y. The purpose here is to provide arrangements to permit pouring the contents of the bottle on tilting the same and to prevent refilling with spurious goods. To accomplish this use is made of a closure locked within the neck of the bottle and having a self-closing valve, a vent and a pouring spout, the last having a cracked joint connection with the neck of the bottle.

Hardware and Tools.

COMBINATION TOOL.—C. A. NORBERRY, Box 306, Fort Bragg, Cal. This invention comprises a miter square having a pivoted blade with a protractor attachment to indicate the position of the blade, a spirit level and scratch-awl, a recess or notch in one edge to adapt



COMBINATION TOOL.

the device for use as a center gage, and a plurality of means carried by the pivoted blade for marking a mortise on lumber, by the person using the tool.

RAZOR BLADE SHARPENER.—C. ALTER, 500 E. 83rd St., Manhattan, N. Y., N. Y. The invention provides a blade sharpener, which is simple and durable in construction, easily manipulated and arranged to permit convenient and quick sharpening of the ordinary razors or the blades of various makes of safety razors.

LOCK.—R. FEOLA, 2 E. 120th St., Manhattan, N. Y., N. Y. This invention refers more particularly to a lock which comprises any suitable key-controllable mechanism including a bolt-actuated member, a casing, a bolt therein, means for operatively connecting the bolt and the actuating member, and means whereby the connecting means can be rendered inoperative to adapt the bolt for manual operation independently of the key-controllable mechanism.

BIT AND HOLDER.—J. W. JOHNSON, 514 Third Ave., Leavenworth, Kan. The object of the invention is to provide a bit holder or brace chuck arranged to facilitate the exchange of different bits, to securely hold bits of different sizes in position and to prevent pulling of the bit out of the socket while the bit is in use.

Heating and Lighting.

INCANDESCENT GAS MANTLE.—A. F. MILLAN, Mannington, W. Va. Mr. Millan's invention is an improvement in incandescent mantles, and has for its object the provision of means in connection with a gas mantle for increasing the light, and for concentrating the rays beneath the source of light.

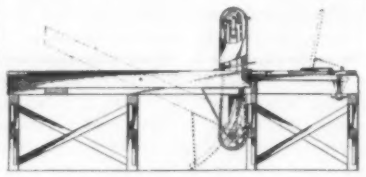
Household Utilities.

WINDOW SUPPORT AND HOLDER.—J. W. PENNEWILL, Silver City, New Mex. The purpose here is to provide a device adapted to hold the lower sash of a window at any desired elevation, and a further object is to provide a device which may be utilized as a lock for the lower sash to prevent it from being raised.

Machines and Mechanical Devices.

AUTOMATIC NEEDLE FEEDER FOR PHONOGRAPHS.—E. C. JORDAN, 1111 D St., Sacramento, Cal. This invention relates to attachments for phonographs on which removable needles are used, and it provides a device which will insure the least possible delay and trouble in making the renewals of the needles. By the use of this device there is little or no excuse for not renewing the needles according to the highest demands.

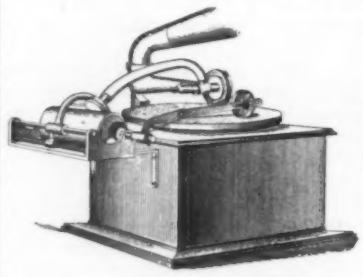
DUMP AND SAFETY LOCK THEREFOR.—H. A. WORKHOVEN and J. L. BOUMA, Orange City, Iowa. This invention relates more particularly to elevator dumps, and more especially to that class of dumps employing rockable timbers in connection with a dump platform, the timbers being spaced to receive the



DUMP AND SAFETY LOCK.

wheels of a wagon, and to drop under the weight of the load.

SOUND REPRODUCING MACHINE.—C. RAMUS, Ellis Island, New York, N. Y. Among the principal objects which the present invention has in view are: to provide a machine adapted to be operated by records of different shapes; to provide an attachment whereby the usual disk-operated machine may be utilized

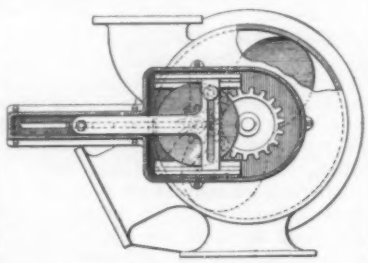


SOUND REPRODUCING MACHINE.

for sound-reproduction of cylindrical records; and to provide a simple mechanism for operatively connecting said attachment to the disk machine.

Prime Movers and Their Accessories.

PUMP AND PRIME MOVER.—C. F. NORDMARK, 91 W. Neptune St., West Lynn, Mass. This invention has reference to machines capable of use as pumps and as prime movers, and relates more particularly to a device of

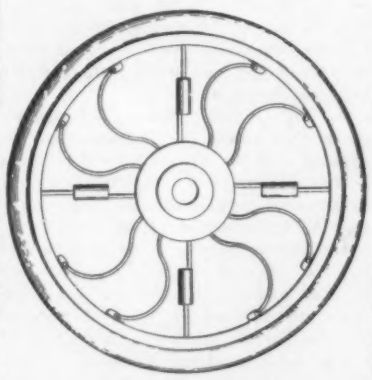


PUMP AND PRIME MOVER.

this class which comprises a casing having an inlet and an outlet, a rotor in the casing, a movable abutment adapted to co-operate with the rotor; and an operative connection between the rotor and the abutment, and located at the outside of the casing.

Pertaining to Vehicles.

RESILIENT WHEEL.—H. LAFLEUR, 175 Mechanic St., Leominster, Mass. In the present invention the improvement relates to the wheels of vehicles and particularly to those of motor cars, and it is the design of the in-



RESILIENT WHEEL.

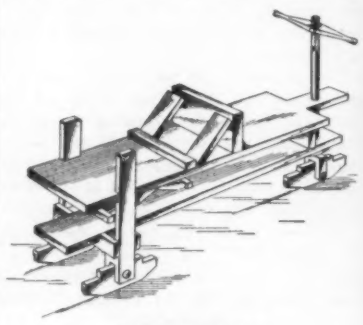
ventor to improve in various particulars wheels of the general character indicated to the end that efficiency in operation may be promoted, as well as economy of manufacture and simplicity of construction.

VEHICLE WHEEL.—A. SCOTT, care of W. C. Vandewater, care of First National Bank Building, Princeton, N. J. This invention provides a wheel with a fixed rim having recesses in its periphery in which plugs on a rim are normally disposed, the plugs being held normally against rotation relatively to the fixed rim by catch members which, at the will of the operator, may be moved out of the path

VEHICLE WHEEL.

of the plugs, so that the rim may rotate relatively to the fixed rim where the plugs are disposed at the lateral openings in the fixed rim to permit removal of the rim from the fixed rim by moving the rim laterally relatively to the fixed rim.

SLED.—J. J. WHEELEN, West St., Gardner, Mass. This invention relates to sleds and has for its object an inexpensive, compact sled, light in weight and compact in construction, which can be used on level ground, as well as on hills, which can be easily steered, and,



PORTABLE SLED.

when necessary, transported by the rider. This is accomplished by providing a frame mounted on runners, one of which is steerable, and a seat on the frame having a collapsible back rest, which has means for facilitating the transportation of the sled by the rider.

Designs.

DESIGN FOR CARPET OR RUG.—J. L. FOLSOM, care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug, the border is composed of three bands, and the center of up and down and across double and curving lines that form irregular shaped spaces filled with cross-hatching.

DESIGN FOR CARPET OR RUG.—H. A. HOWE, care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug, the border is composed of an outer and an inner band, between which is a wide band of geometrical figures. The center is composed of squares and oblongs of different sizes and a large centerpiece with four corners and four intermediate points.

DESIGN FOR CARPET OR RUG.—J. G. PEGEL, care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug, the border is narrow and sparsely dotted. The interior depicts a farmyard scene with a horse and colt, chickens, dog and small girl with a toy-horse.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS WANTED

AGENTS: ASK US ABOUT our snappy household specialty line that will clear you $30 to $80 weekly. National Aluminum Mfg. Co., Box 3A, Lemont, Ill

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from $1.00 to $100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

ONE PERSON WANTED each locality as general agent for complete line Polish Mops, Self-Wringing Mops (5 styles), Fibre Brooms. $5.00 to $10.00 made daily by workers. Hilker Mop Co., 1238 Grand Avenue, Chicago, U. S. A.

RESPONSIBLE SALESMAN OR AGENT, to sell Vance self-oiling wheels and place our royalty license contract. No competition, liberal commission, exclusive territory, permanent income, pocket sample. Vance Self-oiling Wheel Co., St. Louis, Mo.

PATENTS FOR SALE

The FIRST CO. building our Patent Dam, No. 1,047,342, will get one State free. Reinforced concrete, convex upstream, minimum cost, maximum strength, absolutely safe. F. L. Vass, Nile, N. Y.

PATTERN LETTERS

PATTERN LETTERS AND FIGURES. White Metal and Brass, for use on patterns for castings. Largest variety, prompt shipments. Send for catalog. H.W. Knight & Son, 92 State St., Seneca Falls, N. Y.

WANTED

WANTED: Foreman of motor assembling department in a well known automobile plant. Must have exceptional executive ability and fine mechanical training. State experience and wages now earning. Executive, box 773, N.Y.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9298. Wanted the names and addresses of concerns who can turn irregular shaped handles in wood, similar to gun-stock work.

Inquiry No. 9299. Wanted name and address of the maker of a machine for driving fence posts into the ground.

Inquiry No. 9300. Wanted the name and address of a maker of a patented keyless door lock.

Inquiry No. 9301. Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9302. Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized, spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 13 to 22 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale

Inquiry No. 9307. Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308. Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun.

Inquiry No. 9309. Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of hatpin heads made of colored glass; also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Heid Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Boot with iron shoe at bottom—strapped over horse's foot.

Inquiry No. 9314. This enquirer is in the market for some patented articles which he could purchase and manufacture with an investment of from $5,000 to $10,000. The name of the party will be supplied to any of our readers on application.

NEW BOOKS, ETC.

WATER. Its Purification and Use in the Industries. By William Wallace Christie. New York: D. Van Nostrand Company, 1912. 8vo.; 219 pp.; illustrated. Price, $2 net.

The material of this work is a compilation of the apparatus and processes in practical use for the purification of water. The distinguishing features of each machine are admirably picked out by the aid of diagrams and colored inserts. There is much in the way of general information also, and there are numerous tables that cannot fail to be of use to engineers and manufacturers. Water softening, pressure filters and aeration, and the measurement of water, are some of the other headings under which the author writes. Tables, equivalents, and definitions conclude a well-written and informing work.

VOLCANOES. Their Structure and Significance. By T. G. Bonney, Sc.D., LL.D., F.R.S. New York: G. P. Putnam's Sons. 8vo.; 380 pp.; illustrated. Price, $2.

While Prof. Bonney has little, if anything, to say that has not been said before, he has given us a work at once scholarly and entertaining, which in this third edition presents certain alterations and additions that enhance its value by bringing it up to date. Especially is this true in regard to the sixth chapter, dealing with the theories of volcanic action, in which the inferences resulting from modern study are indicated. The destructive eruptions of the Soufrière in St. Vincent and Mont Pelée in Martinique have made these volcanoes the objective of scientific investigators, and the results of their study have been incorporated into the present edition.

GAS ENGINE PRINCIPLES. With Explanations of the Operation, Parts, Installation, Handling, Care, and Maintenance of the Small Stationary and Marine Engine, and Chapters on the Effect, Location, Remedy, and Prevention of Engine Troubles. By Roger B. Whitman. New York: D Appleton & Co., 1912. 12mo.; 248 pp.; illustrated. Price, $1.50 net.

The sub-title is a sufficient indication of the scope of the work, which is well and profusely illustrated, and set up in such clear type, and with so careful an attention to appearance, that it is a pleasure to run over the pages. The inexperienced owner can not fail to absorb from this text-book information that will greatly alleviate his troubles. The work is unencumbered by any discussion of design, or by comparisons of the merits of various constructions.

GAS POWER. By C. F. Hirshfield, M.M.E., and T. C. Ulbricht, M.M.E. New York: John Wiley & Sons, 1913. 8vo.; 209 pp.; 60 figures. Price, $1.25 net.

This is an elementary treatise in which the problem of the heat engine is discussed, the principles of external and internal combustion are set forth, and such subjects as historical development, fuels, methods, accessories, types, and practice, all receive consideration. It is the manual training school student, and others of limited technical education, toward whom the text-book is directed.

THE GAS TURBINE. Theory, Construction, and Records of the Results Obtained from Two Actual Machines. By Hans Holzwarth. Translated by A. P. Chalkley, B.Sc. With additional notes by the Author. Philadelphia: J. B. Lippincott Company, 1912. 8vo.; 140 pp.; 142 illustrations. Price, $2.50 net.

The author spent three years on the development of a practical gas turbine, and his solution of what he truly calls an important technical problem is very adequately set forth in this translation. Part I of the work deals with description and theory; Part II with construction. Part III draws a general comparison between the gas turbine and the reciprocating engine, first treated thermodynamically, and afterward from the point of view of construction and operation. Part IV deals with the results of tests.

STEAMSHIP CONQUEST OF THE WORLD. By Frederick A. Talbot. Philadelphia: J. B. Lippincott Company. 8vo.; 344 pp.; illustrated. Price, $1.50 net.

The author has given us quite an enthralling story of the development of water transportation. The North Atlantic is naturally the predominating scene, since the fight for maritime supremacy here wages the fiercest. The general reader may learn, while at the same time being thoroughly entertained, of the operations of ship building from the laying of the keel to the launching of the monster liner. The luxury of the modern passenger vessel is strikingly shown in pictures of the appointments and fittings of such carved, paneled, and painted halls as are found in the "Deutschland," the "Mauretania," the "Olympic," and their kin. The great fresh-water liners are also pictured and described, and steamless ships furnish an interesting chapter.

STEAM BOILERS. Their Theory and Design. By H. de B. Parsons, B.S., M.E. New York: Longmans, Green & Co., 1912. 8vo.; 377 pp.; illustrated. Price, $4 net.

This fourth edition of a favorably-known work makes its particular bid for notice on the fact that it covers the most perplexing points to be found in practical office work. The reader's acquaintance with boiler-shop practice is taken for granted. The work surveys its field with a great degree of thoroughness, and its merits have been recognized by students and by the engineering profession.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Steel Bodies for Motor Trucks

By Morris A. Hall

AMONG the things that the motor truck has inherited from horse-drawn wagon builders is the wooden body. But repeated experience has shown that this material does not last as it should under the changed circumstances; the heavier loads, the greater speeds, the longer working hours, combine to make the body suffer greater stresses, and wood, under them, goes to pieces rapidly. This situation has brought about a demand for metal bodies. The first of these, and many built since and being built to-day, are not an unqualified success. The reason for this lies in the fact that they are put together with bolts or rivets, which do not withstand the stresses imposed by truck work a great deal better than bolts or screws on the wooden form.

More recently, a process has been developed for producing steel bodies, which includes the use of various successful welding processes in combination with the highly developed pressed steel as a material. The latter is much lighter than ordinary rolled steel sheets of equal strength, while the welding processes unite the members as firmly as the component parts of each sheet. The result is a lighter, stronger, longer lived body of lower first cost when built in quantity, lowered maintenance cost due to lessened depreciation and less tire wear resulting from lowered weight.

Truck manufacturers recently have agreed upon standard body and total weights for given load capacities, basing their figures upon wood bodies. Now, if steel be used a saving results which may be taken advantage of in one of two ways; the load may be kept the same and the lessened tire and other wear taken advantage of, or the load may be increased by the amount saved on the body weight. When 400 pounds can be saved on a 5-ton truck body the standard weight for which is but 1,400, this much may be added to the usual 5-ton load, amounting to 4 per cent. On heavier vehicles, where the body weight in wood runs up more rapidly, the saving is much greater, running above 5 per cent of the load.

It is said the wear of rubber tires varies as the square of the load, the speed remaining constant. On this basis, a 5 per cent saving in body weight would be about 10 per cent saving in tires. The usual mileage guarantee being 8,000 miles, this means the addition of 800.

The exact life of the steel body is not known, but may be inferred in this manner: A Brooklyn builder following the wagon method of riveting and bolting steel plates and structural forms together, has many in use which have seen 14 years' hard service in New York city, hauling coal, than which nothing is more severe. They seem good for some years' use now, and granting that welded pressed-steel bodies are twice as good, the latter should give over 30 years' service. The life of an ordinary wood body does not average much over 6 to 8 years, although there are exceptional cases in which they have lasted, through light work, twice as long.

An advantage in favor of wood at first was the matter of painting; it was extremely difficult to get paint to stick to steel sheets, the result being that they had to be painted often to prevent rusting and the quick destruction of the body in that manner. In the welded pressed-steel forms mentioned the bodies are enameled, and the enamel is baked on, so that it is as hard as porcelain and cannot be chipped off even with a hammer.

The nature of the materials used in the trade which employs the truck has a huge influence. Take the brewery delivery service for instance; the kegs have iron chimes or bands which rust down to a very thin edge. Thus they have a cutting property. They are put in and taken off the wagon rapidly. As a result the rungs, posts, rails and other parts of the body are quickly cut up, and soon require repairing. So great is the need for this that the largest brewers, such as Ehret, Ruppert, Ringling, Central, Lion, and others in New York city, maintain a large and well appointed repair shop which does nothing but repair the bodies. With the motor truck, time spent in the repair shop is a double loss, so this question is of double importance.

The newer forms of steel body would eliminate all this, while the hollow shapes used in the body construction would give greater resistance to sudden blows. The same is true of other firms; the coal body must withstand the water used in wetting the coal as well as the constant erosion of the material sliding in or out. Metal alone will do this, consequently, if wood be used, the body must be steel lined. The same is true for sand and gravel, cinders, broken stone, brick or any similar material. For hospital use, especially in handling patients with contagious diseases, it is important that the body may be rapidly and readily cleaned out and fumigated. With wood this is an extremely difficult job. For tank or other liquid carrying bodies, wood has been abandoned, practically, steel taking its place.

And so it would be possible to go through the whole range of uses to which a motor vehicle might be put and prove that for each and every one the steel body has some advantage over wood, sufficiently weighty to warrant its use in preference to the latter.

An Automobile Field Kitchen

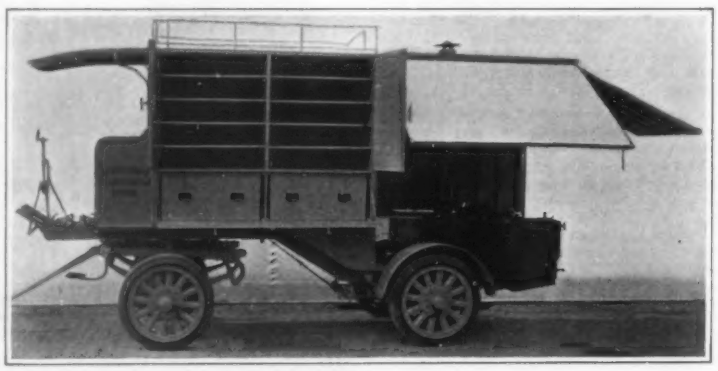
By Our Berlin Correspondent

ONE of the most interesting exhibits at the St. Petersburg Automobile Show, which opened on May 18th, is an automobile field kitchen. This is mounted on a vehicle of 2½ tons carrying capacity attached as trailer to an automobile tractor.

The front part of the vehicle, immediately behind the driver's seat, comprises to the right and left two large fireless stoves each of a capacity of 60 liters (15.85 gallons), above which there are a number of pigeon holes for preserves, bread, etc. The rear part of the vehicle is taken up by the field kitchen proper, which mainly comprises a double walled steam kettle of about 200 liters (52.8 gallons) capacity. The space between the double walls is filled with glycerine, which on one hand protects the dishes against any risk of burning, and on the other hand allows the contents of the kettle, after putting out the fire, to go on cooking on the well known fireless cooker principle. This is the more important as the smoke given out by the fire might draw the attention of the enemy to the troops encamped in the neighborhood. The glycerine bath allows the contents of the kettle to be kept hot for about 6 to 8 hours. In addition to the main kettle there are arranged sideways a coffee kettle of 20-gallon capacity with a special fireplace, reservoirs for storing the apparatus used in preparing the dishes, spices, coffee, and the like. The kitchen gases from both fire-places are discharged through a common chimney.

This kitchen has been designed to prepare within 2½ hours food and coffee for about 200 to 250 men. As soon as the contents of the kettle are ready, it is transferred into the fireless stoves to be taken in them to the men in the field. It is thus possible in 24 hours to feed about 2,000 men. The kitchen, by the way, is very economical in operation, only about 18 to 22 kilogrammes (8 to 10 pounds) of wood being required for preparing the food for 200 to 250 men, while any other fuel available in the field can be used as well.

This field kitchen can be mounted on an automobile truck instead of on a trailer, thus allowing the motor to be used at the same time for the operating of kneading and chopping machines, etc., which are readily stored on the vehicle. However, the field kitchen car would in this case not be available for other uses, whereas the automobile tractor is advantageously employed for carrying such provisions as cannot be placed on the trailer.



An automobile field kitchen for the Russian army.

Rear of the trailer, showing the kitchen proper; also the motor tractor in which provisions are carried.

Tar Bonded Roads in Cincinnati

CINCINNATI is the scene of a number of important successful road contracts where the macadam has been rendered automobile-proof by the use of a refined tar binder. This was one reason why the American Road Makers' Convention was held there in 1912.

Madison Road, the sole eastern thoroughfare in the city, affords the oldest instance of tar bonding. It carries a traffic so heavy that a contractor who took a traffic record, reported that macadam could not be used at all.

In 1907 the north side of this road was resurfaced with tar bonded macadam to afford a comparison with native rock asphalt and plain macadam. Within a year the tar bonded section had so clearly demonstrated its superiority that the property owners petitioned for more of it, and in 1908 the remainder of the road was accordingly reconstructed with the tar. Since then the road has been uniformly in excellent condition and has cost nothing for maintenance except a little patching and a partial treatment with a surface coat of a thin grade of tar.

Erie Avenue was bonded with tar in 1908 and required no attention until 1912, when several holes were repaired and the surface was given a renewal treatment with tar. Before the use of tar binder, this avenue had required resurfacing every six months.

Observatory Road, another important thoroughfare, had been impossible to maintain in even reasonably good condition previous to the use of a tar binder in 1909. Since then it has been in excellent condition and required no attention until it received a surface treatment in 1912.

Grandin Road, another heavy traffic street, had required resurfacing twice a year until in 1907, when it was bonded with tar. After that one surface treatment with tar was enough to keep it in good shape.

The tenacity of the tar bond was interestingly illustrated on Hillside Avenue in 1912. On a steep hillside section there was a landslide which shifted the foundation of the road. The tarred surface, however, instead of breaking, stretched and twisted very much as if it were a big sheet of rubber.

In 1911 Cincinnati abandoned the use of plain macadam on all main thoroughfares and substituted the tar bonded type of construction.

An Acetylene Storage Tank.—A patent has been issued to the Searchlight Gas Company, of Chicago, as assignee of Joseph Hidy James of Pittsburgh, Pa., for an acetylene storage tank, No. 1,055,915, and in which the tank is filled with corn pith and a solvent for acetylene gas.

Dussaud's "Cold Light"

(Concluded from page 489.)

other words, an apparatus so small that it can be carried very easily in the hand. The absence, or rather the quick dissipation, of heat enables the operator to run the film off as slowly as he pleases and even to stop it entirely in order to study one particular picture on the screen.

Because of this rapid dissipation of heat, it is possible to employ celluloid instead of glass plates for ordinary lantern slides. There is no danger of setting the celluloid on fire or of causing it to shrivel up. Dussaud confidently prophesies that with his cold light it will be possible to use celluloid films ¾ of an inch by 1 inch in size instead of glass plates 3¼ by 4 inches. The celluloid can be cut into long strips, perforated along the edges so that it can be printed mechanically, as in making moving picture positives. Indeed, Dussaud claims that a single operator can make twenty-five thousand celluloid prints a day. These tiny photographs can be made by any amateur at a cost of not more than a cent, and can be projected on the screen by means of small, cheap projectors (Fig. 1).

Opaque bodies, postal cards, illustrations in books, and other objects can be directly thrown upon the screen in enlarged form by reflecting lanterns. The image, which appears in all its colors, relief, etc., on the canvas, is 3½ yards square. Two lanterns can be employed when dissolving views are to be projected, in which case it is not necessary to employ the usual shutters, but simply to rely wholly on the commutators of the apparatus (Fig. 2).

By means of cold light auto-chrome plates can be projected, which otherwise suffer when exposed to the electric arc. Powerful lights can be concentrated upon parts of the human body without danger of scorching them, with the result that foreign bodies can be located very readily in the muscles. The hand, when held close to a powerful cold light, appears translucently pink.

As one of our photographs shows, the cold light can be employed in photographing interiors. The inconveniences attending the use of ordinary magnesium flash powder are well known. Powerful cold lights render it possible to make very brief exposures without polluting the atmosphere of the small room with smoke.

With a small electric battery and a simple lens, a beacon light of long range can be cheaply produced. Such an apparatus will be found serviceable on small sailing boats as well as by soldiers. It is easy enough with such a device to telegraph optically for great distances.

Disposal of New York's Sewage

(Continued from page 490.)

tical experience. It is only the combination that is new. The water within a mile of the island in all directions varies from 7 to 40 feet in depth, the average being about 20 feet below mean low tide. The form of the island is shown in our front page illustration. It will cover about twenty acres. It is planned to build a rip-rap wall by laying large pieces of broken stone at the site upon the hard sandy bottom. As the water cuts away the sand from under the stone, more stone will be added until settlement ceases. Within the wall sand will be poured from a suction dredge. As the water is shallow, no serious difficulties will be encountered in the filling operations. The island will be about 18 feet above mean low water, 1,000 feet wide and 1,300 feet long. It is estimated that the island may be constructed for about $615,000. At the landward end of the island there will be a small harbor for the tank steamers that are to carry the sludge out to sea. A shelter will be provided by a breakwater.

The tunnel under the bay will be 14 feet in diameter. Starting with the siphon under the East River, it will be 8 feet 9 inches in diameter and will be blasted out of solid rock at a depth of 110 feet. After passing under the river it will rise to a level of about —35 feet and here will

have a diameter of 10 feet 3 inches, then at the Wallabout pumping station it will rise to sea level and will run from there to the junction of the Jamaica Bay interceptor with a diameter of 12 feet 8 inches. The siphon under the East River will be about 2,300 feet long. It will be purposely made of small diameter so that there will be sufficient velocity of flow to prevent the deposit of solids. If the Manhattan interceptor is extended it will be necessary to build a second siphon parallel to the first. It is considered necessary for the velocities in the siphon to range between 2 and 5 feet per second.

The general pumping station at Wallabout will be able to handle two hundred million gallons a day. The sewage here will have been passed through settling chambers and will be in a reasonably fresh condition. The pumps will have to raise the sewage and pump it under a head of about 45 feet to the artificial island. The island will be about 11.8 miles from the pumping station.

At the outlet island the sewage will be delivered into settling tanks. The proposed construction of these tanks is indicated in the accompanying drawing. Each tank is formed with inverted pyramidal settling basins. Between the tanks are conduits through which the sewage flows. Every other conduit *A* is an influent. Running from these conduits are pipes *B* that deliver the sewage near the bottom of the settling basins. The solid matter collects in the form of sludge at the bottom of the basin, where it is subjected to a certain amount of pressure due to the head of the liquid matter, causing it to be forced up the discharge pipes *C* into the mains *D*, whence it will be forced into the tank steamers either by the head of liquid in the settling tank, or if this is not sufficient, by low-pressure pumps. If necessary the liquid sewage matter will be treated to render it harmless and then it will overflow into the conduits *E* and pass out through discharge pipes under sea level on the seaward side of the island. The discharge pipes may be extended far out to sea if it be found desirable.

At this island 203,000,000 gallons of sewage could be taken care of, or about one third of New York's present sewage. A thousand tons of sludge would be removed daily.

Don, the "Talking" Dog

By Dr. Leonard Keene Hirshberg, A.B., M.D. (Johns Hopkins)

DR. HARRY MILES JOHNSON, of the Johns Hopkins University, has just announced the result of his analysis of "Don," a German setter, seven years old, belonging to the royal game warden Ebers at Theerhutte in Gardeldgen. Numerous other observers report that he has a vocabulary consisting of eight words, which he speaks if food is held before him, and the following questions propounded in German: "Was heisst du?" "*Don.*" "Was hast du?" "*Hunger.*" "Was willst du?" "*Haben, haben.*" "Was ist das?" "*Kuchen.*" "Was bittest du dir aus?" "*Ruhe.*" Moreover, he was said to answer categorical questions by "*Ja*" and "*Nein,*" and in reply to another question, to speak the name "Haberland." Among others whom popular report mentioned as witnesses to this extraordinary ability of the dog was Mr. Oskar Pfüngst, of the Psychological Institute of the University of Berlin, whose important tests on the horse of Mr. von Osten, "Der Kluge Hans," have lately been published in English. Mr. Pfüngst had in fact investigated the behavior of the dog in collaboration with Prof. Vosseler and Dr. Erich Fischer, keeping detailed memoranda on the tests, and making a number of phonographic records. Partly to clear up misapprehension of his own position and partly for the enlightenment of the serious general public, he gave out a brief popular report of his work.

Having proposed three definitions of speech: first, properly, as the use of vocal sounds to convey to the listener an idea experienced by the speaker; secondly, more loosely, as the production of vocal sounds learned by imitation, but used without knowledge of their meaning to the hearer; and, thirdly, as the production of vocal sounds not imitative of human speech having no meaning to the speaker, but producing in the hearer illusions of definitely articulated, spoken words, uttered to convey meaning, Mr. Pfüngst then asks to which class the speech of Don properly may be referred.

First, it is plain enough that the dog does not use words with any consciousness of their meaning to the hearer. His vocabulary is always given in order, beginning with "*Don*" and ending with "*Ruhe.*" If the order of questioning is varied he is called "*Kuchen*" and he desires "*Hunger,*" etc. (Here it may be noted that the author was unable to get even approximations to the last three words in the list accredited to the animal.)

Secondly, it is evident, says Mr. Pfüngst, that he is not using words learned by imitation. The author assumes that any imitator of another speaker would vary the pitch, intensity or accent of his words as the imitatee's were varied. Don's voice—a high tenor, ranging from *F* on the bass clef to the octave above middle *c*, usually pitched in talking near *d* above middle *c*—is not varied when the pitch of the questioner's voice is altered. Furthermore, he does not imitate changes in accent or intensity. He is as likely to say "*Kuchen*" as "*Küchen,*" "*Hunger*" as "*Hünger,*" etc. From the legitimacy of the author's adoption of this criterion, however, the reviewer is inclined to dissent. His own experience with a child of two and one half years, learning readily to speak a large number of words and phrases from imitation, and able to give both vowel and consonant values with perfect distinctness, showed that for several months she could not be made to change intensity or pitch, although she usually showed apparent willingness to try. To apply this principle in the case of the dog would require the assumption of an attentive ability as well as of motor skill, far in excess of any of which that animal has given evidence.

But Mr. Pfüngst offers other disproof of the imitation hypothesis which seems really adequate. This is found in the method of learning. The first word which the dog is reported to have uttered is "*Haben.*" We are assured that being asked, "Willst du etwas haben?" he thereupon pronounced distinctly the words, "*Haben, haben, haben,*" and was rewarded with food for his pains. When he afterward attempted to pronounce the words he would give many inarticulate gurgles, but the food was given only when the correct number of syllables were uttered at once. The family state that ten repetitions, some a week apart, sufficed for this learning. The word "*Ruhe*" was first uttered after a command, "*Ruhe,*" by the owner's daughter. Hearing the dog's response, she demanded, "Was sagst du da?" and obtained the answer again, "*Ruhe.*" He was then taught to give this word after his fifth question, "Was bittest du dir aus?" The name, "*Haberland,*" which none of the investigators could obtain from him, was first answered without instruction to the question, "*Wer hat den ersten Artikel über dich in die Zeitung gebracht?*" These facts are hardly consistent with any probable experience in learning by imitation. Indeed, it may be remarked that to one who has spent the greater part of two years in experimentation on behavior of the dog under controlled conditions, the animal's vagueness of perception and extremely low degree of attention would make a very strong presumption against the possibility of his learning even the simplest acts by "observation and imitation."

Mr. Pfüngst concludes that the speech of Don is therefore to be regarded properly as the production of vocal sounds which produce illusions in the hearer. He calls attention to the fact that not even the number of syllables in any given "word" of Don's is constant. The dog makes only one vowel sound, having a value lying between *o* and *u* varying considerably, but usually nearer *u*. The experimenters could not hear from him certainly either *a* or *e*. His one guttural-aspirant is like the German *ch*, and does duty for *k* and *h*. There is also a nasal, of a value lying between *n* and *ng*. When it is not prolonged it passes for a *d*,

"*Don.*" He really never makes the sound of *b*, *d*, *k*, *l* or *r*. When he utters a word expressed by *ch | unguo*, not much effort is required from a suggestible hearer to perceive the sound as "*Hunger.*" When in making phonograph records the questioner asks merely "Was?" the dog gave the customary answers, "*Don,*" "*Hunger,*" "*Haben, haben,*" "*Kuchen,*" etc., of which however only two out of sixteen answers were intelligible. Of one hundred and sixty-eight answers preserved on phonograph records, seventy-one per cent were disyllabic, and of the monosyllabic noises sixty-eight per cent were given when a considerable pause had elapsed between the last answer and this question. The "answers" were really incorrect fully as often as otherwise. Disinterested hearers could seldom distinguish his "*Hunger*" from his "*Haben,*" or his "*Ruhe*" from his "*Kuchen,*" etc. It was as easy for others to perceive some of these same sounds as "*Engelhopf*" or "*Hallelujah,*" "*Huhn*" or "*Honig.*" Here it seemed to the author we have a case quite parallel with our common interpretation of the night-swallow's calls as "whip-poor-Will," when in fact the sounds are nearly "Pfif-ah-rih;" and with the common German interpretation of their *Steinkanz's* "*kuwitt*" or "*kuwiff*" as "*komm-mit,*" thus making him in popular superstition the messenger of death. But for a strong and uninhibited tendency thus to "apperceive" them, neither these calls nor the "words" of Don would be taken as other than meaningless noises.

On psychological grounds, Mr. Pfüngst concludes, the explanation is comparatively simple: the uncritical do not make the effort to discriminate between what is actually given in perception and what is merely associated imagery, which otherwise gives to the perception a meaning wholly unwarranted; and they habitually ignore the important part which suggestion always plays in ordinary situations.

These explanatory truths being accepted, we may expect the majority of animal lovers to continue to read their own mental processes into the behavior of their pets. Nor need we be astonished if even scientists of a certain class continue at intervals to proclaim that they have completely demonstrated the presence in lower animals of "intelligent imitation" and of other extremely complicated mental processes—inferred from the results of brief and lamentably superficial tests, and published as proven facts without further reflection.

Naphthalin as a Binder for Anthracite Briquettes

THE pitch commonly used as a binder in making briquettes of anthracite is rather dear, hence a cheaper substitute has long been sought. Naphthalin, another by-product of the coke-ovens, is specially fitted for this purpose, and many experiments have been made with the object of evaporating it and mixing it intimately with the particles of coal by means of superheated steam.

The process proposed by Busz-Fohr has hitherto not been very successful, but recently, according to *Glückauf*, it has been considerably improved by Schürer and made practically useful.

The naphthalin is melted in a melting pot by steam at about 100 deg. Cent. and then led into the coil of an evaporator in precisely measured quantities. The coil is played upon by superheated steam at 300 to 350 deg. Cent., so that the naphthalin in the coil evaporates.

The steam issuing from the evaporator drives an apparatus which sucks the evaporated naphthalin out of the coil and forces it into the steam kneading apparatus filled with coal, where the two are thoroughly mixed.

Actual experiments prove that by using a percentage of naphthalin in place of the pitch a saving of 0.5 M. per ton is effected.

In this connection it may be mentioned that naphthalin is also finding an application as fuel for combustion motors. According to *La Nature*, at the Creusot works a 70 horse-power naphthalin engine is being built for use on the Siberian Railway.